











# EXPERIMENT STATION RECORD.

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As the war goes on, there are many indications that one of its results will be to demonstrate anew the value of generous and systematic provision for the encouragement of agricultural research. The urgent demand for information for immediate application has revealed as the essential prerequisite the possession of a substantial fund of scientific knowledge. It has made it clear that the accumulation of such a body of knowledge is not a matter to be improvised in an emergency but something to be attained gradually by carefully planned investigation. The situation has directed attention to what has already been accomplished by research institutions fostered by public funds, and has stimulated inquiry and discussion as to means for so strengthening such institutions as to bring about their maximum efficiency.

Reference has recently been made in these columns to the unusual interest which is being manifested along these lines in England and even more largely in France, where elaborate plans are already under consideration for the reorganization of the whole system of agricultural research, instruction, and extension activities. Concern in the matter is, however, by no means confined to Europe, but may be said to be virtually world-wide in scope.

One of the countries in which definite plans are being formulated to develop agricultural research more effectively is Australia. Although that Commonwealth is geographically far removed from the boundaries of the United States, many of the conditions there prevailing have for us special interest. Both countries are still relatively new agricultural regions and embrace approximately equal land areas. Both contain within their borders a wide and somewhat comparable range of climatic conditions, including large tracts with insufficient rainfall. In each case agriculture and animal husbandry rank among the most important industries. There are also certain points of resemblance as to constitution and government, notably as to the division of powers between the Federal authority and the several States, which necessarily influence the development of Federal and State institutions.

Agricultural research in Australia has been in progress on an organized basis since approximately the date of passage of the Hatch Act in this country. There has been, however, no provision for a Federal system of either agricultural education or research, nor is there any institution corresponding to our own Federal Department of Agriculture. This is less surprising when it is recalled that the Australian Commonwealth was not organized until 1901, and that during the previous decade strong State departments of agriculture had become established.

Research activities have thus far been centered almost entirely in these State departments of agriculture. They exercise administrative control over the agricultural colleges in their territory, in connection with which experimental farms have been carried on for many years. They also conduct farms and laboratories of their own for general experimental work, as well as farms devoted to viticulture, irrigation, sugar cane, stock feeding, utilization of prickly pear, dairying, and similar specialized branches. They operate many demonstration farms and plats and engage quite extensively in regulatory and similar control functions. Another distinctive feature is their publication of monthly farm journals which constitute their principal means of dissemination of the results of their experimental work and other information of interest to farm periodicals, agricultural societies, farmers, and others.

Most of the experimental farms are of great size and provided with excellent equipment for large-scale field work. For instance, in New South Wales the Hawkesbury Agricultural College, which has carried on experimental work since 1892, has a farm of 3,500 acres, of which over 200 acres is in experimental plats. The Wagga State Experimental Farm comprises 3,300 acres, with several thousand varieties of fruit under test and extensive work with cereals and live stock. The Roseworthy Agricultural College and Experimental Farm in South Australia, founded in 1882, has a farm of about 1,600 acres and 100 acres in permanent experiments, and the corresponding institution at Dookie, in Victoria, opened in 1886, has a farm of about 4,500 acres, of which about 400 acres is annually devoted to experiments with cereals and fodder plants. In all, there are about 30 stations or farms devoted to experimentation, with a total farm area of nearly 50,000 acres. In addition, there are about 50 experimental orchards, vineyards, and semipermanent areas.

The most important single line of research has probably been the production of new varieties of wheat, in which much progress has been attained. This work has been conducted at a large number of stations, notably at the Cowra Station in New South Wales and the Werribee Central Research Station Farm in Victoria, and the various institutions referred to above.

Most of the laboratory work is directly attached to the State departments of agriculture at their several headquarters. A wide range of activity is under way, including studies of plant and animal diseases, insect pests, chemistry of soils and wheat, soil biology, and numerous other lines.

*At the outbreak of the war a large amount of experimental work was in progress and substantial results were being obtained. At the same time a feeling had been developing that the lack of any central organization was leading to some overlapping in the investigations undertaken by the several States, and that steps should be taken to secure greater coordination of effort. This view had been expressed as early as 1911 by the Scottish Agricultural Commission, which, in response to an invitation from the Australian Government, spent several months in a survey of rural conditions and activities in Australia. In the words of this commission, "it appeared to us that a considerable amount of overlapping was going on; that, in general, there was a want of coordination and cooperation; that the policy of allowing each State to attempt to attack the solution of each agricultural problem by itself was not the most economical. There are many problems which are common to the whole of Australia, or to the greater part of it, and it would appear that time and money would be saved by placing some of the work of research in the hands of a Federal department." The difficulty was regarded as most serious in the study of animal diseases, the control of prickly pear, and similar large-scale undertakings.*

In 1916, apparently as a war measure, the Governor General of Australia appointed what is termed an "advisory council of science and industry" for the purpose of furnishing advice to the Government on questions relative to scientific research. An appropriation of \$25,000 was subsequently made available for its use. This council has functioned chiefly through an executive committee, of which the prime minister of the Commonwealth has been chairman and Prof. D. Orme Masson, of the University of Melbourne, deputy chairman. Several others prominent in agricultural science are members of the committee, and a large share of its attention has been given to problems connected with agricultural research.

The committee has collected information regarding the present status of experimental work in agriculture and the relations of the various agencies through which it is being conducted. Its acting secretary accompanied the prime minister in a visit of inquiry to North America and Great Britain, and subsequently published an interesting monograph on the organization of scientific research institutions in the United States. What is termed a "science abstractor" was also appointed to summarize available data, prepare

bibliographies, and institute a Commonwealth catalogue of scientific periodicals. A register of research work in scientific and technical laboratories has already been prepared, and it is planned to supplement this with a similar register of the experimental work at the various Government farms.

A number of special committees were also organized, with small grants of funds. Some of the committees have carried on actual experimental work, taking up such projects as the methods of extraction of potash and aluminum from alunite, the tanning properties of certain Australian woods, the electrical sterilization of milk, and the means of transmission of the worm nodule parasite in cattle. Other committees were formed to review existing information and report as to the best lines of future investigation of such problems as tick control, combating of nodule disease in cattle, and the diminution of losses to stored products by insect pests. Most of these questions were found to be too large and complex for handling through a temporary organization or to necessitate action by the Federal Government in cooperation with the State authorities. A similar view was taken as to several other projects inquired into by the executive committee itself, such as the institution of a soil survey, the eradication of the prickly pear, and the encouragement of cotton and flax production.

The principal recommendation of the advisory council has been for the immediate creation of a Commonwealth institute of science and industry. Under the plan proposed, this institute would be established by act of Parliament as a permanent institution. It would be organized purely for research activities and carefully dissociated from all routine control work.

Among the functions suggested for the institute are the initiation of scientific researches in connection with the primary industries of the Commonwealth, the collection of industrial scientific information, and the establishment and maintenance of special national laboratories. The coordination and direction of scientific work in the various existing institutions, with a view to the prevention of undesirable overlapping of effort, is specifically proposed. The stimulation of scientific research through grants to institutions, co-operation with scientific societies, and assistance to educational authorities in advancing scientific teaching and the training of investigators are also suggested.

The "primary industries" referred to, of course, include crop raising and animal husbandry, and it is evident that large attention would be given to their problems. A definite program is set forth for the initial years of operation which includes studies in plant genetics, plant pathology and insect pests, soil fertility and biochemistry, the breeding and feeding of live stock and the improve-

ment of dairy products, the control and eradication of animal diseases, economic biology, plant utilization, the extension of cotton and flax growing, forestry, and the development of improved machinery. The establishment of special national laboratories is suggested for research in dry farming, control of animal pests and diseases, and utilization of forest products.

The administration of the institute would be vested in three salaried directors, appointed by the governor general, one to be a business man with ability in organization, and the others chosen mainly for scientific attainments and experience. An advisory council representing science and the principal industries would also be selected for each State. The institute staff would be appointed by the governor general, upon recommendation of the directors.

The general features of the organization and lines of work of this somewhat novel institute have been approved provisionally by the Commonwealth Government, but at the time of writing no notice of the formal adoption of the project has been received. The advisory council has been earnestly urging immediate action, as it has felt that its temporary organization was inadequate for the purpose in view. Moreover, several of the States have been anxious to undertake various scientific investigations which it was believed should be under the direction of a Commonwealth institution, and it was thought that the early commencement of the enterprise, in which great stress is laid upon the principle of cooperation between the institute and the States, would prove of much advantage.

Further evidence of Australian interest in agricultural research is afforded by an account just received of the proceedings of a week's conference on that subject, held at Melbourne in November, 1917. This conference was called by the executive committee of the advisory council and was attended by representatives of the council, the State departments of agriculture, the various agricultural colleges and universities, and others interested in agricultural science. Inasmuch as there exists in Australia no organization comparable to the Association of American Agricultural Colleges and Experiment Stations, the assembling of this conference was in itself a matter of some significance.

The conference program consisted largely of the presentation of scientific papers similar in scope to those usually offered in the agriculture section of the Australian Association for the Advancement of Science, but having special reference to the status of research under the war conditions. Several of the papers dealt with problems connected with cereal improvement, the acclimatization of plants, and studies of the native grasses and fodder plants, while others took up the tobacco, sugar, and fiber-plant industries, crops for

the production of power alcohol, and the utilization of the phosphate deposits of Australia. One entire session, however, was devoted specifically to a general discussion of agricultural research, with addresses entitled, "Some suggestions as to the Commonwealth Endowment of Agricultural Research," by Prof. A. J. Perkins, director of agriculture in South Australia, and Agricultural Research and the Prevention of Overlapping, by Mr. R. D. Watt, professor of agriculture in the University of Sydney. These addresses were followed by an extended discussion.

The paper offered by Prof. Perkins advocated especially the development of research in the universities. These institutions, unlike the agricultural colleges, are not connected with the State departments of agriculture, and for various reasons apparently have not thus far been able to give much attention to agricultural research. Prof. Perkins's plan contemplates the location of permanent agricultural research stations at these institutions, financed, if necessary, by Commonwealth appropriations. He announced that at one university, that at Adelaide, land has already been made available for the purpose and plans are under way for the commencement of operations by means of private contributions. He also favored the granting of financial assistance for approved experimental work by private individuals.

The address of Prof. Watt likewise directed attention to the opportunities for developing research in agriculture at the universities, though he pointed out that the number of university students in agriculture is at present too small to warrant a sufficiently large staff for extensive development. He suggested the propriety of the private endowment of research scholarships and fellowships.

The shortage of adequately trained research workers was referred to by several speakers as one of the principal obstacles in the way of extension of activities at the present time. The Australian agricultural colleges, while well attended, are designed primarily to turn out practical farmers, and, although five universities have been offering courses in agriculture for about 10 years, enrollment has always been small, and in recent years has been diminishing. This condition is attributed in part to the restricted field now open to the university graduates in agriculture. A resolution was adopted by the conference, requesting the advisory council to bring the need of training more research workers to the attention of the universities. In this connection it is of interest to note that the University of Melbourne has itself been making special inquiries along this line, and a committee has submitted a new degree course as a foundation training for prospective teachers and investigators.

The question of the establishment of the proposed permanent institute of science and industry was not directly presented to the

conference nor was definite action taken concerning it. Reference to, however, was made in various papers, and it is evident that the project has received much consideration. Some apprehension was expressed against any procedure which might unduly centralize or "officialize" research, while other speakers regarded the project as likely to prove extremely beneficial in several directions. Prof. Watt suggested as quite conceivable the eventual evolution of the agricultural activities of the institute into something approximating a Federal department of agriculture. Numerous references were made to the organization of agricultural agencies in the United States, and the conference adopted a recommendation requesting the early appointment of a permanent agricultural representative from Australia to this country to keep in touch with methods of work and similar matters.

While it thus appears that there are some difficulties to be confronted in the future development of agricultural research in Australia, it is likewise evident that the outlook for increased activity is quite favorable. There seems to be general recognition of the value of research, especially under the present conditions, and a disposition to consider carefully means for its systematic encouragement. The adoption of plans and their development will doubtless be awaited with interest by all who are concerned with the promotion of agricultural research, both in Australia and beyond its borders.

## RECENT WORK IN AGRICULTURAL SCIENCE.

### AGRICULTURAL CHEMISTRY—AGROTECHNY.

**Physical chemistry of vital phenomena**, J. F. McCLENDON (*Princeton, N. J.: Princeton Univ. Press, 1917, pp. VII+240, pl. 1, figs. 31*).—This book comprises a course of lectures and laboratory work given to graduate and advanced medical students in the University of Minnesota. "The purpose of the book is not to go far into physical chemistry but to develop a tool for physiological research." A discussion of the general principles of physical chemistry is followed by chapters on enzyme action; permeability of cells; negative osmose and the polarization of membranes in relation to the bioelectric phenomena, stimulation, absorption, and secretion; anesthesia and narcosis; cytolysis and disinfection; amoeboid motion and tropisms, cell division, fertilization, and parthenogenesis; muscular contraction, oxidation, and heat and light production; and blood and other cell media. An extensive literature list is appended.

**Chemistry in the service of man**, A. FINDLAY (*London: Longmans, Green & Co., 1917, 2. ed., pp. XVI+272, pls. 3, figs. 23*).—The basis of this book is a series of lectures delivered in 1915 the aim of which was to present in a non-technical form "some account of what the science of chemistry, both in its general principles and in its industrial applications, has accomplished for the material well-being and uplifting of mankind." In this, the second edition, the book remains essentially unchanged, but a new chapter on fermentation and enzyme action has been added.

**Technical handbook of oils, fats, and waxes**.—I, **Chemical and general**. P. J. FEYER and F. E. WYSTON (*Cambridge, Eng.: University Press, 1917, vol. 1, pp. [X]+279, pls. 42, figs. 33; rev. in Jour. Soc. Chem. Indus., 37 (1918), No. 1, p. 23 R; Analyst, 43 (1918), No. 503, pp. 75, 76*).—This book was designed primarily to furnish a survey of the main facts relating to the chemistry and technology of oils, fats, and waxes of animal, vegetable, and mineral origin to meet the need of the technical worker, the works chemist, and students. It contains sections on the chemistry, testing and analysis, classification, and production and refinement of oils, fats, and waxes, and one on oleoresins and essential oils. A special feature is the colored diagrams of the more important analytical determinations showing the limit of extreme variations and the average value for each substance.

It is stated that a companion volume on the methods used in the analysis of oils, fats, and waxes is in course of preparation.

**The oils in cherry pits**, H. L. MAXWELL (*Chem. News, 117 (1918), No. 3042, pp. 122-124, fig. 1*).—Crushed dried cherry kernels were extracted with ether and the resulting oil examined for its physical and chemical properties. The kernels gave a yield of 37.6 per cent of a mixture of oils of the characteristic odor of almond oil. About 10 per cent of the oil solidified at a temperature of  $-5^{\circ}$  C., the rest remaining liquid to about  $-20^{\circ}$ . The larger fraction was found to have a specific gravity of from 0.922 to 0.925 and a saponification number of 276.8. These results and other characteristic tests show that the oil is essentially the same as almond oil.

An extraction apparatus is described consisting of two flasks connected by means of two siphon tubes, one extending to the bottom and the other just below the cork in each flask. The flask in which the material to be extracted is placed is also connected with a reflux condenser. Both flasks are half filled with the solvent and the longer siphon tube is also filled. The flasks are then heated on water baths. The vaporized ether from the second flask passes through the short siphon and is condensed in the reflux condenser. This increases the volume of ether in the first flask, thus starting the siphon which carries the ether and the dissolved oil back into the second flask. The operation is continued as long as necessary. The apparatus can be used with various solvents and on different substances and is said to be very accurate and economical in time and solvent.

The oils of gourd seed (squash and pumpkin), A. TRELLE (*Vic Agr. et Rurale*, 8 (1918), No. 12, pp. 203-206, *figs. 3*).—The composition of the seeds of various members of the gourd family is given, together with the yield and properties of the oil and oil cake derived from them. The author suggests the utilization of such oils where possible for the table and otherwise for lighting and lubricating purposes.

The peanut (*Inst. Colon. Marseille, Bul. Sect. Mat. Grasses*, No. 4 (1918), pp. 48).—This publication contains descriptions of the various types of machines for shelling peanuts, and a French translation of Farmers' Bulletin 751 on peanut oil (E. S. R., 35, p. 806). Statistics are also given of the production and exportation from various countries of the oil of the coconut, soy bean, olive, whale, and flax plant. Tables are included showing the importation of fruits, seeds, and oils into Marseille in 1916 and importations and exportations in England for the years 1915, 1916, and 1917.

The loganberry and the acid content of its juice, M. R. DAUGHTERS (*Jour. Indus. and Engin. Chem.*, 10 (1918), No. 1, p. 39).—This continues the analysis of the loganberry previously noted (E. S. R., 38, p. 203), this paper giving the composition of the fresh whole berry and four additional analyses of the juice with special reference to its acid content.

The composition of a sample taken from 14 lbs. of fresh ripe berries was found to be as follows: Total solids, 20.74 per cent; moisture, 79.26; citric acid, (anhydrous), 1.52; Invert sugar, 7.35; sucrose, absent; proteins (N×6.25), 4.55; fat (ether extract), 0.613; crude fiber, 1.38; and ash, 0.571 per cent.

The citric acid was determined by the Kunz modification of Stabre's method (E. S. R., 36, p. 415), the applicability of which to fruit juices has been proved by Dunbar and Lepper.<sup>1</sup>

Citric is the chief acid of the loganberry. Traces of tartaric and volatile acids are present. Malic acid is absent.

Methods of pure culture study, H. J. CONN ET AL. (*Jour. Bact.*, 3 (1918), No. 2, pp. 115-128).—This is the preliminary report of the committee on the chart for identification of bacterial species and consists of methods to be put into provisional use for routine bacteriological work. Directions are given for the preparation of media, invigoration of cultures, and the study of the morphology, cultural characteristics, and physiology of bacteria. A glossary of terms is appended.

Colorimetric determination of reaction of bacteriologic mediums and other fluids, G. D. BARNETT and H. S. CHAPMAN (*Jour. Amer. Med. Assoc.*, 70 (1918), No. 15, pp. 1062, 1063).—The authors describe a method devised to determine fairly accurately hydrogen ion concentration without the necessity of prepar-

<sup>1</sup> *Jour. Assoc. Off. Agr. Chem.*, 2 (1917), No. 4, pp. 175-182.

ing standard solutions. The principle used is that of superimposing the two extreme colors of the indicator as outlined by Clark and Lubs (E. S. R., 37, p. 506) in determining the so-called half-transformation points of indicators. The method as outlined covers a range of hydrogen ion concentration from  $pH'$  to  $pH''$ , using phenolsulphonaphthalein as indicator.

Autolysis of yeast and the influence of its proteolytic products on the growth of the yeast and of lactic acid microorganisms, P. VANSTEENBERGHE (*Ann. Inst. Pasteur*, 31 (1917), No. 12, pp. 601-630).—In this article are discussed the conditions necessary for yeast autolysis, as reported by other investigators and determined experimentally by the author, and the nutritive value of the autolyzed yeast compared with the extract of nonautolyzed yeast.

The optimum temperature for autolysis was found to be from 48 to 50° C. Indications of successful autolysis are the increase of acidity to a certain fixed degree and the crystallization of tyrosin in the extract. Yeast extract obtained by simple boiling of fresh yeast in water contains only one-third of the total nitrogen of the yeast. Autolysis of the yeast for 23 hours at from 48 to 49° transforms all of the nitrogen into soluble products not coagulable by heat and of much better quality than in the original yeast. The extract of autolyzed yeast is more nutritive for the yeast and lactic acid organisms than that obtained by simple boiling. The nutritive value may be attributed to a mixture of proteolytic products among which peptone plays the most important part. Small quantities of a series of substances, including lecithin, asparagin, and tyrosin, exert, independently of peptone, a favorable influence on yeast and on the lactic acid organisms. In a more concentrated form, these amino acids exert a harmful effect upon the growth of yeast. The value of malt extract may also be attributed to the presence of a series of proteolytic products analogous to those in autolyzed yeast.

What are enzymes? B. HOROWITZ (*Sci. Mo.*, 6 (1918), No. 3, pp. 253-259).—This is a popular historical summary of investigations on enzymes.

Organic nitrogenous compounds in peat soils.—III, The nitrogen distribution in peat from different depths, C. S. ROMINSON and E. J. MULLEN (*Michigan Sta. Tech. Bul.*, 35 (1917), pp. 3-29, figs. 9).—Investigations are described dealing with the application of some of the methods of protein analysis to a study of the nitrogenous compounds in peat soil, based upon previous investigations made at this station (E. S. R., 25, p. 623) which, together with similar work done elsewhere, are thought to have demonstrated the protein origin of organic nitrogenous materials in soils. The present work has to do primarily with a study of the variation in nitrogen partition in peat with depth or age and state of decomposition; with a comparison of its composition with that of pure proteins; and with a determination of the possible relationship between chemical composition, as determined by the above mentioned methods of analysis, and nitrogen availability as determined by the alkaline permanganate method. Considerable analytical data are presented in tabular form, illustrated by graphs, and fully discussed, and form the basis for the following conclusions:

"There is no regularity in the variation of total nitrogen and ash content with the depth of the deposit, the fluctuations being determined rather by the conditions of formation and the composition of the peat-forming vegetation. The amounts of the larger groups determined by the Van Slyke method do not consistently show a regular increase or decrease with depth and, where the botanical composition of the peat-forming plants was approximately constant they showed no variations in quantity above those ascribable to experimental errors in their determination. It follows that the organic nitrogenous materia-

s extremely resistant to decomposition under the conditions in a peat deposit and it must be regarded as a possibility that the constitution of some of the components of some of the groups, notably those included under acid amids, differs radically from those usually attributed to these compounds. In comparison with ordinary proteins, peat contains a larger percentage of acid amid and humin nitrogen and a smaller amount of basic and nonbasic nitrogenous compounds. The available nitrogen as determined by the alkaline permanganate method did not show any regular variation with the depth of the deposit. In quantity it somewhat exceeded the acid amid nitrogen with which it seems to give slight indications of being associated. Owing, however, to the lack of any distinctive form in the curves no certain relationship could be demonstrated.

The freezing point method as a new means of studying velocity of reaction between soils and chemical agents and behavior of equilibrium, G. J. BOYD and W. A. LAUDERMAN (*Michigan Sta. Tech. Bul.* 37 (1917), pp. 32).—In his investigation the freezing point method has been used to study the velocity of the reaction between soils and chemical agents, such as salts, acids, and bases, and the behavior of the equilibrium. The apparatus employed was the same as that used in investigations previously noted (E. S. R., 38, p. 16). The procedure consisted of mixing soils and reagents together and determining at once and at various intervals the freezing point lowering. From these depressions the velocity of reaction and behavior of equilibrium were ascertained. The results are summarized as follows:

"The velocity of the reaction between mineral soils and mineral and organic salts is extremely rapid if not almost instantaneous, and the equilibrium attained remains constant for a long time. Thus, the depression is already constant before 4 minutes have elapsed and continues to remain constant for a period of 60 days and even 100 days in some cases.

"The reaction between various soils and acid phosphate salts is also very rapid at the beginning, but the equilibrium does not remain stationary in all of the soils. Thus, the freezing point lowering is already constant before the expiration of 4 minutes and continues to remain constant for the next 20 minutes during which it is studied, and then begins to decrease in all the soils except the sand and peat.

"The behavior of the equilibrium in peat treated with the various salts is somewhat different from that of the mineral soils treated with the same salts. In the peat the depression of the acid phosphate salts remained constant while that of the nitrates and acetates decreased.

"The behavior of the reaction between the different soils and different acids is entirely different. Any one acid acts entirely differently upon the various soils and conversely, any one soil is acted upon entirely differently by the various acids. On the whole, however, the data show that the initial velocity of the reaction is very rapid and that the initial equilibrium remains constant for at least 25 minutes in all the soils. Then this equilibrium begins to change in some of the soils while it remains constant in others.

"The initial velocity of the reaction between bases is also extremely rapid and the equilibrium attained remains constant for a long time in all the bases except in the  $\text{Ca}(\text{OH})_2$ . In this case the equilibrium changes in some of the soils while it remains stationary in others."

An accurate loss-on-ignition method for the determination of organic matter in soils, J. B. RATHER (*Arkansas Sta. Bul.* 140 (1917), pp. 3-16, figs.).—The basis of the method described is the fact that the minerals in the soil which interfere with the accuracy of the loss-on-ignition method for the

determination of organic matter can be removed by successive digestions with a 1 per cent acid solution containing 0.5 per cent each of hydrochloric and hydrofluoric acids without decomposing or dissolving more than a slight amount of organic matter. The procedure is as follows:

A 1 gm. sample is digested twice with 50 cc. of water for five minutes on a boiling water bath or at 85° C. and decanted through a Gooch crucible, using suction. The extract is transferred to beakers and concentrated to a few cubic centimeters. The residue is digested six times with 10 cc. of 2.5 per cent hydrochloric acid, 10 cc. of 2.5 per cent hydrofluoric acid, and 30 cc. of water. After washing with water, the residue is transferred to a small dish and the concentrated water extract added. After drying to constant weight at 100°, the residue is ignited and the total organic matter calculated from loss on ignition. A more rapid and in most cases quite as satisfactory method omits the water extraction, *disregarding the possible water-soluble organic matter in the soil* since duplicate analyses have shown that, except in the case of some soils very rich in organic matter, the results in both methods are practically the same.

The investigation includes results of examination of the effect of the acid reagent on hydrated and unhydrated minerals, on the mineral matter in different kinds of soil, on the loss on ignition and on the organic carbon in the soil. A table is given of the analyses of 25 varieties of soils for organic matter by the two methods outlined above and by the older organic carbon and loss-on-ignition methods.

The author believes "that the method for the determination of organic matter outlined in this paper eliminates the errors in the loss-on-ignition method due to hydrated minerals and carbonates and probably to unoxidized minerals, and that it is superior to the organic carbon method for the determination of organic matter in soils."

The volumetric determination of sulphates in water extracts of soils, A. W. CHRISTIE and J. C. MARTIN (*Soil Sci.*, 4 (1917), No. 6, pp. 477-479).—The volumetric method for the estimation of small amounts of sulphate in the urine by titration of the precipitated benzidin sulphate with potassium permanganate, as described by Raiziss and Dubin (E. S. R., 33, p. 415), has been adapted by the authors at the California Experiment Station to the determination of small amounts of water-soluble sulphates in soil. In the final titration  $\frac{N}{20}$  potassium permanganate is used, 1 cc. of which is calculated to equal 0.15 mg.  $\text{SO}_4$ . Care should be taken in the washing of the precipitate, as if less than 15 cc. of wash water is used high results are obtained, indicating that the excess reagent has not been entirely removed, while with more than 20 cc. low results are obtained, due to the slight solubility of benzidin sulphate.

The accuracy of the method has been tested with sulphate solutions of known concentration and with a typical 1:5 soil extract. The method has an average error of 3 per cent and is believed to be superior to colorimetric or nephelometric methods, especially for small amounts of sulphate.

A study of the De Roode method for the determination of potash in fertilizer materials, T. E. KEITT and H. E. SHIVER (*Jour. Indus. and Engin. Chem.*, 10 (1918), No. 3, pp. 210-222; *abs. in Chem. Abs.*, 12 (1918), No. 10, pp. 1095, 1096).—The author reports results obtained at the South Carolina Experiment Station for the determination of potash in fertilizer materials by the method proposed by De Roode (E. S. R., 6, p. 887) and later by Moore (E. S. R., 10, p. 408). The method, which is applicable to all commercial fertilizers, including salts, is described in detail, and analyses are reported of samples of commercial fertilizers and various synthetic solutions of known composition by the modified De Roode and the official Lindo-Gladding method.

Some of the advantages of the modified De Roode method are ease and simplicity of manipulation and a higher degree of accuracy due to the elimination of incineration, precipitation, filtration, and prolonged evaporation. By avoiding ignition, porcelain dishes may be used instead of platinum.

**The precipitation of phosphoric acid as ammonium phosphomolybdate: A practical determination of phosphoric acid by a simple nitrometric measurement.** J. CLAEENS (*Compt. Rend. Acad. Sci. (Paris)*, 166 (1918), No. 6, pp. 59-262).—The author has proved that the precipitate obtained by the action of the molybdate reagent under the usual conditions is insoluble in distilled water.

Nitric acid, 1 part in 100, dissolves first from the precipitate a very small portion of phosphoric acid easily determined, and also a larger more important fraction not containing phosphoric acid but which is a true ammonium nitromolybdate. The remaining precipitate is a mixture of diammonium and triammonium phosphomolybdates in proportions depending on the concentration of ammonium salts in the precipitating liquids.

By increasing the proportion of ammonium salts in the precipitating liquids by addition of ammonium nitrate, nitric acid is replaced progressively by ammonium nitrate until the amount of ammonia existing in the precipitate is the same as if all the phosphoric acid had been precipitated as triammonium phosphate. The amount of ammonium nitrate to be used should be from 15 to 20 m. of the salt for 100 cc. of the molybdate reagent. The determination of phosphoric acid becomes then a determination of ammonia, which can be brought about by any nitrometric method after dissolving the precipitate in potassium hydroxid.

**Compilation of recommended methods for the physical and chemical examination of water and sewage.** A. V. DELAPORTE (*Ann. Rpt. Prov. Bd. Health Ontario*, 85 (1916), pp. 147-149).—The methods outlined are those employed at the experimental station of the Provincial Board of Health of Ontario and are similar to the standard methods of water analysis of the American Public Health Association. Exceptions are the use of an alkaline methyl range solution as a permanent standard for ammonia instead of the platinum cobalt standard and, as a permanent standard for nitrates, a solution of fuchsin to which is added a little copper sulphate solution. In estimating nitrates by the phenol sulphonic method in samples of high chlorin content, sufficient standard sodium chloride solution is added to the standard to make the chlorin content the same as in the sample and thus render unnecessary the precipitation of chlorin in the solution.

**Deterioration in asparagus.** K. G. BITTNER (*Nat. Canners Assoc. Bul.* 11 (1917), pp. 18, pls. 5).—The histological changes taking place in cut asparagus under different conditions of temperature, length of standing, etc., were determined by the increase in lignification observed in transverse sections stained with safranin. Tests were also made for tannin and coniferin in view of the development of a bitter principle coincident with the toughening.

The experiments reported indicate that in order to retain the tenderness and delicate flavor of freshly cut asparagus the stalks should be canned within 4 hours after cutting. If it is necessary to hold them for a longer period they should be kept at as low a temperature as possible and the large stalks scraped deep enough to remove the zone of bast fibers which is the material agent in the toughening.

**The direct or Breed method for counting bacteria in tomato catsup, pulp, and paste.** CHARLOTTE VINCENT (*Jour. Bact.*, 3 (1918), No. 2, pp. 183-185).—The direct method of counting bacteria devised by Breed (E. S. R., 26, p. 274) was

compared with the standard Zeiss blood counter method as described by Howard (E. S. R., 24, p. 613). The direct count was found to give much larger numbers of bacteria than the Zeiss method, the advantages being that a bacillus can always be distinguished from micrococci or inert material and that micrococci can be counted, as they are easily stained and recognized in this method.

The nature of the inositol phosphoric acids of some important feeding materials, J. B. RATHER (*Arkansas Sta. Bul.* 188 (1917), pp. 3-16; *Jour. Amer. Chem. Soc.*, 40 (1918), No. 5, pp. 523-536).—The author has continued his study of the nature of the inositol phosphoric acids in feeding materials by an examination of wheat bran, corn, Kafr corn, oats, rice bran, and rice polish. The method of preparation previously noted (E. S. R., 37, p. 502) was used in all cases and was checked in the case of wheat bran by the method of Auderson (E. S. R., 33, p. 11).

The results indicate that the principal phosphoric acid in all the materials studied is inositol pentaphosphoric acid of the composition  $C_6H_6(OH)(H_2PO_4)_5$ . Determined quantitatively by the author's method, previously noted (E. S. R., 38, p. 11), this acid was found to be from 75 to 95 per cent of the acid-soluble phosphorus, while the inorganic phosphorus was from 3 to 18 per cent, leaving from 0 to 13 per cent to be accounted for in other forms. While the presence of other inositol phosphoric acids is not excluded by this work, the author concludes that they can not be present in amounts much exceeding 10 per cent of the total acid-soluble phosphorus.

Note on the colloid chemistry of Fehling's sugar test, M. H. FISCHER and MARTIN O. HOOKER (*Jour. Lab. and Clin. Med.*, 3 (1918), No. 6, pp. 368-373, pl. 1, figs. 3).—The variations in color of the precipitate formed with Fehling's solution and reducing materials are explained from the point of view of colloid chemistry. A microscopic examination of drops taken at intervals from a mixture of Fehling's solution and dextrose shows that, as the solution becomes more opaque and undergoes successive color changes from blue-green to red, the actively motile particles which are first noted gradually increase in size. These observations show that "the different colors observed in the reduction of Fehling's solution by dextrose (or other reducing substances) are nothing more than color changes coincident with a gradual increase in the size of copper oxid particles." The formation of intermediate colloidal substances is due to several factors among which are (1) too high a concentration of the reducing substance, resulting in the exhaustion of the copper salt while the copper oxid particles are still small, (2) the presence of various protective colloids which tend to stabilize the reduced copper oxid, (3) the stabilizing action of the intermediate products formed by the action of the alkali of Fehling's solution on the reducing substance when the latter is present in large amounts, and (4) too high a temperature giving less time for the formation of particles of the size characteristic of the red precipitate.

Contribution to the analysis of milk.—I, Determination of fat and casein without centrifugation: II, Agreement of the ratio casein: fat for the detection of skimming, F. RERFROY (*Ann. Chim. Analyt.*, 23 (1918), No. 1, pp. 11-15).—The following method for the analysis of milk is described:

By means of a copper-potassium hydroxid solution the casein of the milk is precipitated together with all the fat and some of the mineral salts. The precipitate, washed with dilute alcohol, is dried at 100° C. for four hours and weighed. This gives the weight of fat, casein, and mineral matter. The precipitate is then ashed and the amount of mineral matter calculated. The fat is determined by drying a 10 cc. sample of the milk with 5 gm. of sea sand and dissolving the fat with ether. The percentage of casein is calculated by difference.

The ratio casein:fat, as determined from a large number of analyses of milk, gives a maximum result of 0.82 for a pure unskimmed milk. Whenever this figure is exceeded it is deemed certain that other investigations would confirm the conclusion that the milk had been skimmed.

**Determination of fatty acids in butter fat:** I. E. B. HOLLAND and J. P. TUCKLEY, JR. (*Jour. Agr. Research [U. S.], 12 (1918), No. 11, pp. 719-732, figs.*).—Continuing the work at the Massachusetts Experiment Station on butter fat, previously noted (E. S. R., 35, p. 111), the authors have devised a method for the determination of five of the fatty acids in butter by direct esterification of butter fat with consequent fractionation of the resulting esters. The method is as follows:

In a liter flask are placed 150 gm. of filtered fat, together with 400 cc. of alcohol previously charged with 8 gm. of dry hydrochloric acid, or 4 cc. of concentrated sulphuric acid, and about 25 glass beads. The flask is connected with a reflux condenser and the mixture boiled for 24 hours on a wire gauze. The contents of the flask are then cooled, and, after addition of 50 cc. of ether and 150 gm. of magnesium chloride, transferred to a liter separatory funnel and allowed to stand until a clear separation is secured. After the lower alcohol layer is drawn off, the esters are carefully shaken several times with from 25 to 50 cc. of ether and 50 cc. of an alcoholic solution of magnesium chloride and finally filtered into a 500 cc. distillation flask. The filter is extracted with ether which is run into the flask containing the alcohol layer and washings from the esters, and the process of separation and extraction is repeated to recover any occluded esters which are then combined with the original extract.

The distillation flask is connected with a 12 in. Liebig condenser and heated in a bath of superheated valve oil. The exposed portion of the flask should be covered with asbestos paper and the condenser filled with cold water which should not be allowed to circulate. The distillate between 85 and 365° C. is collected, combined with the distillate from a second portion of butter fat treated in the same way, and subjected to fractional distillation. The required temperature range of every fraction must be accurately established by analyses with the apparatus used. The fractions are collected in tared flasks, weighed, and the saponification and iodin numbers determined as rapidly as possible. From these data the percentage and weight of the different esters in the fractions and of the corresponding acids may be determined. A table is included giving the necessary data for these calculations.

Analytical data are given of the application of the method to a sample of dry filtered butter fat churned from sweet cream.

**Distinguishing manila from all other "hard" rope fibers:** C. E. SWETT (*Jour. Indus. and Engin. Chem., 10 (1918), No. 3, p. 227*).—The method employed consists in treating the sample with a solution of bleaching powder acidulated with acetic acid and then with ammonia. The manila fibers take a russet-brown color while all other fibers turn cherry-red. The difference between the red and brown is most evident at the end of three or four minutes after fuming with ammonia. With practice it is possible to estimate the manila content of a rope to a single fiber.

**Maple products:** A. T. CHARBON (*Rpt. Min. Agr. Prov. Quebec, 1917, pp. 79-83*).—Analytical results are reported showing the danger of overconcentration of maple syrup to the point of the crystallization of some of the sugar, thereby reducing the amount of syrup and leading to the suspicion that the product had been adulterated with cane sugar. The samples under suspicion, while pure according to the legal standards, had a water content of less than 25 per cent, showing that the concentration had been pushed too far.

Analyses of suspected samples of maple sugar showed figures for total ash and lead number below the legal limit. The suggestion is made that this is a result of repeated crystallization of the product whereby a large amount of the pectin is removed from the syrup. Extreme purification of maple sugar deprives it of its special characteristics and prevents its being placed on the market as a pure maple product.

The influence of reducing sugars in the sugar-cane sap on the clarification of the juice in the carbonitration process for the manufacture of white sugar in Java, H. A. C. VAN DER JAGT (*Chem. Weekbl.*, 15 (1918), No. 8, pp. 228-242).—The fact that sugar cane which is used for the manufacture of sugar in Java contains varying amounts of reducing sugars, while beet sugar is almost glucose-free, is emphasized in a discussion of the De Haan carboultion process and the Harloff acid thin-juice process as practiced in Java. A comparison of the double carbonitration processes as used in Europe and in Java is given in tabular form.

The evaporation of prunes, C. I. LEWIS, F. R. BROWN, and A. F. BAES, (*Oregon Sta. Bul.* 145 (1917), pp. 36, figs. 28).—This publication was issued in the interests of the standardization of prunes. Methods of harvesting, preparing, and evaporating the fruit are discussed and detailed descriptions given, illustrated by diagrams and photographs, of various types of evaporators.

Tables are given showing the effect of climatic conditions and drying time on the weight of the fruit. From investigations extending over a number of years the authors find that there is a loss ranging from 5 to 9 per cent in the drying percentage due to unfavorable weather conditions, particularly moisture. The proper moisture content of evaporated prunes is estimated at from 17 to 18 per cent. Data collected over a period of two years show that there is very little change in the drying percentage until the drying time becomes abnormally long, but that there is a marked difference in appearance, texture, and flavor of the fruit. These seem to be better when the drying time is relatively short.

Apple flakes, W. P. JAMES (*Illinois Sta. Circ.* 213 (1918), pp. 8, figs. 2).—This publication describes a new form of dried apple which is recommended as an army food. The product is prepared by peeling the entire apple with an ordinary apple peeler, mixing the prepared apple tissue with dry sugar in the proportions of 2 gm. of sugar to 10 gm. of apple tissue, and drying from 12 to 14 hours under mechanical conditions corresponding to those used in commercial drying. The resulting product can be packed in boxes as it comes from the drier or concentrated by powdering or compressing into small capsules, or made into a cake coated with powdered sugar and wrapped in tin-foil.

The advantages of the product are (1) the moisture content is low, which insures long keeping; (2) the physical structure of the tissues is such that the product can absorb water readily up to the original content; (3) the coloring is controlled without bleaching the tissues; (4) the flavor, sugar, acid, and probably the original food constituents are not appreciably affected; (5) the use of sugar gives an additional food value to the product; (6) the expense of production should be less than that of the sulphur-dried apple; and (7) the cost of transportation is reduced to the minimum. It is estimated that 25 tons of fresh apples would make approximately 2½ tons of dried product.

#### METEOROLOGY.

Climate, R. DEC. WARD (*New York and London: G. P. Putnam's Sons, 1918.* 2. ed., rev., pp. XV+380, figs. 34).—This is a second revised edition of a book previously noted (E. S. R., 20, p. 812). In a prefatory note the author states

that in this edition he has made "some revision of the chapters on The Characteristics of the Polar Zones and on Changes of Climate, in order that these subjects may be more accurately presented in the light of recent investigations. A few other changes have also been made and all errors which occurred in the first edition have been corrected."

The diurnal variation of wind with height, L. DUNOYER and G. RENOUL (*Compt. Rend. Acad. Sci. [Paris]*, 185 (1917), No. 26, pp. 1068-1071; *abs. in vi. Abs., Sect. A—Phys.*, 21 (1918), No. 243, p. 100).—"Results of observations with pilot balloons in France carried out at all hours of the day and night show that at heights of from 200 to 800 meters the diurnal variation of wind velocity shows a pronounced maximum during the night, especially when the surface wind is light and coming from the east. The effect is masked by the influence of depressions, and it is therefore not well shown with westerly winds."

On the relation between barometric pressure and the water level in a well at Kew Observatory, Richmond, E. G. BILHAM (*Proc. Roy. Soc. [London]*, *Ser. A*, 94 (1918), No. 658, pp. 165-181, figs. 4; *abs. in Sci. Abs., Sect. —Phys.*, 21 (1918), No. 243, pp. 100, 101).—"Observations are recorded which show that "(1) at all seasons of the year the water level is sensitive to changes of pressure, a rise of the barometer being associated with a fall of water level and vice versa, (2) within certain limits the change of level is proportional to the change of pressure producing it, (3) the magnitude of the range of level produced by a given change of pressure increases rapidly as the subsoil water level rises, and (4) there is no appreciable lag in the response of the water level to changes of pressure." A possible explanation of these facts observed is suggested.

The divining rod, D. VAN GELIK (*Scot. Jour. Agr.*, 1 (1918), No. 2, p. 219).—"The results are reported of tests to which four diviners were subjected by the Society of Natural Sciences of Wageningen, Holland, as follows: (1) Tracing underground streams and controlling their courses in a given area and (2) determining whether underground conduits were full of water or dry. The results indicated that any apparent success of the diviners was due to superficial control and their observation and previous knowledge of the ground. In the search for predetermined water currents, correct answers were obtained in 23 cases and incorrect in 25.

Climatological data for the United States by sections (U. S. Dept. Agr., *Weather Bur. Climat. Data*, 4 (1917), Nos. 11, pp. 229, *pls.* 3, *figs.* 3; 12, pp. 32, *pls.* 3, *figs.* 4).—"These volumes contain brief summaries and detailed tabular statements of climatological data for each State for November and December, 1917, respectively.

Meteorological records for 1916 (*New York State Sta. Rpt.*, 1916, pt. 1, pp. 35-806).—"Tables are given showing tri-daily readings at Geneva, N. Y., of standard air thermometers for each month of the year; daily readings of maximum and minimum thermometers at 5 p. m. for each month of the year; monthly summary of maximum, minimum, and standard thermometer readings for the year; monthly and yearly maximum and minimum temperatures from 1883 to 1916, inclusive; average monthly and yearly temperatures since 1882; and rainfall by months since 1882.

Meteorological records for the years 1915 and 1916, H. L. PRICE (*Virginia Sta. Rpts.*, 1915-16, pp. 209-213).—"Tables are given which show tri-daily readings of air temperature at Blacksburg, Va., during 1915 and 1916, as well as a monthly summary of observations on temperature, precipitation, winds, and cloudiness at this place during the same period.

Rainfall distribution over France, A. ANGOT (*Rev. in Symon's Met. Mag.*, 52 (1918), No. 624, pp. 136, 137; *abs. in Nature [London]*, 101 (1918), No. 2527, p. 95).—"This is the first portion of a contemplated large investigation into the rainfall distribution over France, and deals with the régime over the north-west Provinces. . . . The variability of rainfall based on records for sixteen stations in France, and adjacent countries during the second half of last century is discussed, from which it is shown that the departures of individual years from the normal are in accordance with the theory of probabilities. A list of the stations arranged in river basins is given by departments, along with the altitude and the period of observation. Monthly isohyetals are drawn at intervals of 10 mm. up to 100 mm., but at 120 mm. and 150 mm. thereafter, while on the annual maps the intervals extend to 100 mm. A summary of the leading features governing the rainfall distribution is given for each month and for the year."

#### SOILS—FERTILIZERS.

Classification and measurement of the different forms of water in the soil by means of the dilatometer method, G. J. BOYDUCOS (*Michigan Sta. Tech. Bul.*, 36 (1917), pp. 48, figs. 5).—In a continuation of work previously noted (E. S. R., 36, p. 719), the author presents additional data obtained by the dilatometer method on the condition in which moisture exists in the soil and its classification into free, capillary-absorbed, and combined, and describes the final form of the apparatus adopted and the procedure followed. The studies were directly and primarily suggested by work conducted by the author and McCool on the freezing-point lowering of soils (E. S. R., 38, p. 16). The results of the examination of 73 agricultural soils, varying widely in nature and distribution, are reported showing the amount of water that failed to freeze under different moisture conditions and temperature treatments. In addition, certain miscellaneous materials were employed, including peat, muck, silica, laupblack, animal charcoal, quartz sand, and burnt clay, and observations were also made on the effect of salts (normal and tenth-normal sodium chloride, calcium chloride, sodium nitrate, calcium nitrate, potassium chloride, calcium phosphate, and ammonium sulphate) upon the amount of water that failed to freeze. The investigations may be summarized as follows:

"For classifying the moisture into the various forms the following principle is followed: All the water in the soil that freezes at or slightly below 0° is considered free water because pure water in mass is known to freeze at this temperature. All the water that freezes from this temperature down to -78° C. is regarded as capillary-adsorbed water, while all the water that fails to freeze is considered as combined water.

"The procedure of the method consists of mixing soil and water in the bulb of the dilatometer in certain proportions (25 grains of air-dry soil and 5 or 10 cc. of water), filling the dilatometer with ligroin, care being taken to expel as much air from the soil as possible, and then cooling the soil to the desired temperature. For determining the free water the soil is supercooled only once to the temperature of -1.5°; for determining the capillary-adsorbed water the soil is frozen and thawed several times and then supercooled to -4° and also cooled in the temperature of -78°. The combined water is obtained by the difference."

In soils supercooled only once to the temperature of -1.5° the amount of water which failed to freeze varied from 0 cc. in quartz sand to about 4.25 cc. in some clays, or from 0 to 85 per cent on the basis of the amount of water added, or from 0 to 21.88 per cent on the absolute dry basis. As a general rule

increased from the coarse-textured or noncolloidal to the fine-textured or liquid classes of soil. In soils frozen and thawed several times and finally supercooled to  $-4^{\circ}$  and also cooled in  $-78^{\circ}$  the amount of water which failed to freeze varied from 0 cc. in quartz sand to about 2 cc. in some clays, or from 140 per cent of the amount of water added, or from 0 to 12.5 per cent on the absolute dry basis. It also increased from the coarse-textured to the fine-textured classes of soil. "The results at these temperatures are the same as at the temperature of  $-1.5^{\circ}$  with two important exceptions: First, the amount of water which failed to freeze at the temperature of  $-1^{\circ}$  and  $-78^{\circ}$  considerably smaller than that at the temperature of  $-1.5^{\circ}$ . . . . Second, relative amounts of water which refused to freeze at the two sets of temperatures are not the same in the various soils." In artificial substances the amount of water that failed to freeze varied from 0 per cent in quartz sand 2 per cent in lampblack, to 32 per cent in silica, and to 60 per cent in peat, the absolute dry basis.

When the amount of water which freezes and does not freeze at the various temperatures is classified into free, capillary-adsorbed, and combined, by the method described, it is found that the water in the soil does exist in these forms but that the amount of these forms varies tremendously in the various soils; "the sands and fine sandy loams the free water predominates, amounting in these cases to about 95 per cent of the total water present, and the other 5 per cent consisting as a rule of combined water, capillary-adsorbed water apparently being present in these classes of soil. In the loams and silt loams the free and combined water predominates, capillary-adsorbed water being present in all amounts. In some of the heavy loams all three forms were about equally distributed. In clay loams, humus loams, and clay, combined water predominated, followed by capillary-adsorbed and free. "Although the amount of free water tends to decrease and the amount of the capillary-adsorbed and combined water tends to increase correspondingly as the soils descend from the simple liquid noncolloidal to the complex and colloidal classes there are many exceptions to this rule.

The amount of water which fails to freeze is not influenced by the moisture content present if the soils are frozen and thawed several times before the final determination is made. If the determination is made at the first freezing then the amount of water which fails to freeze is much greater at the low than at the high moisture content. This is true, however, only in the fine-textured or liquid and not in the coarse-textured or noncolloidal types of soil. Repeated freezing and thawing decreases the amount of water which fails to freeze in case of the fine-textured or colloidal soils. This is true, however, only at low and not at a high moisture content. The results of the coarse or noncolloidal soils remain unaffected at both the high and low moisture content. A degree of supercooling, up to a certain point, influences to a slight extent the amount of water which refuses to freeze. This is particularly true in the finer classes of soil. Cooling the soil to the temperature of  $-78^{\circ}$  causes very little if any additional water to freeze above that which freezes at the temperature of  $-4^{\circ}$ . The only substances in which the additional amount is considerable are lampblack, animal charcoal, and silica.

Small concentration of the soil solution affects the amount of water which fails to freeze very little, if any. Great concentration, however, affects it greatly. The concentration of the solution of normal soils is too small to affect to any measurable extent.

There is no correlation between the factor of the amount of water which fails to freeze and the moisture content of soils known as wilting coefficient or moisture equivalent, in degree, but there is in order. The same is more or

less true in the case of the hygroscopic moisture content. There is, however, a very close relation between the amount of water which fails to freeze and the lowering of the freezing point of soils. There is also no definite and consistent correlation between the factor of the amount of water which fails to freeze and the class of soil as determined by the mechanical analysis method.

"The greatest and most important value of the dilatometer method lies in its ability to show the behavior of soils toward water and to classify the water quite accurately into free, capillary-adsorbed, and combined. The combined water seems to be composed of water of hydration and solid solution of water, with the former probably predominating. This problem, however, is considered still unsolved. The factors which cause the water to be in the combined form appear to be the colloids and the chemical composition of the soil. The size of particles or surface of the soil does not seem to play the leading rôle in this form of water. If it does, then it has to be assumed that the surface of different materials holds the water with entirely different degrees of tenacity or compressibility. The results yielded by the dilatometer method are of great importance not only per se but also in throwing new light upon many other soil problems, such as movement of moisture in soils, evaporation of water from soils, etc. The results are fundamental and basic."

The soil solution obtained by the oil pressure method, J. F. MORGAN (*Michigan Sta. Tech. Bul. 28 (1916)*, pp. 7-38, figs. 6).—This presents a more detailed account of work previously noted (E. S. R., 37, p. 717).

Effect of soil moisture on growth and maturity in maize, T. B. HUTCHISON and T. K. WOLFE (*Virginia Sta. Tech. Bul. 14 (1917)*, pp. 73-92; *Rept. 1915-16*, pp. 73-92).—Corn was grown in galvanized iron pots 11½ in. in diameter and 14 in. in height, filled with a mixture of silt loam field soil and green house soil that had been composted and was rich in organic matter. The moisture was maintained in different series at 40 and 70 per cent of saturation continuously or for varying periods or at various combinations of these percentages.

The results show that "for early maturity and high yield in the corn plant, optimum soil moisture should be present throughout the period of growth. Alternate wetting and drying of the soil produces early maturity of the corn plant and high yield of dry matter second only to those plants grown under optimum conditions of soil moisture. Contrary to the opinion of many corn growers, the highest yields of dry matter are obtained when optimum soil moisture is present in the early stages of growth of the plant, rather than at earing time. This condition also hastens maturity. The critical time in the life of the corn plant in regard to both early maturity and high yields, as far as soil moisture is concerned, is in the early stages of growth. The optimum soil moisture content in the later stages of growth of the corn plant, following periods of low soil moisture, retards maturity and lessens the yield. This experiment was carried on in pots in the greenhouse, and whether these results would apply to field conditions the writers can not say."

A list of 22 references to literature bearing on the subject is given.

Soil survey of Wilcox County, Ala., R. A. WINSTON and N. E. BELL (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1916*, pp. 71, fig. 1, map 1).—This survey, made in cooperation with the State of Alabama, deals with the soils of an area of 576,000 acres in the south-central part of the State lying wholly within the drainage basin of the Alabama River. The topography of the county ranges from undulating to hilly, with elevations above sea level of from 275 ft. in the southern part to 475 ft. in the northern part.

The soils of the county are classed as upland and alluvial, the former being derived from the weathering of marine deposits, chiefly unconsolidated sands.

andy clays, and clays, with small areas of black prairie soils derived from silt, chalky, or partially indurated limestone, and the latter being of recent fluvial origin. Thirty-five soil types of 19 series are mapped, the soils ranging from loose, incoherent sands to heavy, sticky clays. Susquehanna clay and Susquehanna fine sandy loam predominate, occupying 15.6 and 14.3 per cent of the total area, respectively.

**Soil survey of Hinds County, Miss.**, A. E. KOCHER and A. L. GOODMAN (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1916, pp. 42, pls. 3, fig. map 1*).—This survey, made in cooperation with the State of Mississippi, deals with the soils of an area of 538,080 acres lying just southwest of the center of the State. The topography of the county varies from smooth or gently rolling to steeply sloping, the greater part of the area having a rolling surface. Extensive level areas occur along the principal streams as terraces and flat bottoms. Drainage is chiefly by the Big Black and Pearl Rivers and their tributaries and is well established.

The upland soils of the county, comprising about five-eighths of its area, are derived from loessial material, except for a small portion of coastal plain and Oksburg limestone origin. The alluvial soils are derived from material washed from the drainage basins of the streams and deposited over their flood plains. Grenada silt loam, Memphis silt loam, Olivier silt loam, and Collins silt loam predominate, occupying 45.8, 15.5, 14.1, and 13.6 per cent of the total area, respectively.

**Soil survey of Lee County, Miss.**, W. E. THAYER and E. M. JONES (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1916, pp. 40, fig. 1, map 1*).—This survey, made in cooperation with the State of Mississippi, deals with the soils of an area of 286,720 acres located in the northeastern part of the State. The topography of the county is generally undulating to strongly rolling, a part of the east-central section being hilly. Comparatively wide bottoms occur along many small streams.

"The region is underlain by the Selma Chalk, a soft, impure, bluish-gray limestone rock that weathers rapidly upon exposure. . . . This rock is exposed in many places, and throughout considerable areas it is covered by only a thin layer of residual material, of which the rock itself has contributed the greater part. Its direct influence upon the soils would be greater were it not for the presence of a yellowish silty clay on most of the broader divides, termed in geological literature the Yellow Loam. In the eastern part of the county there are large areas whose surface formation consists of rather deeply weathered soils. These three formations . . . constitute the parent material of all the soils of the county." Excluding chalk (Houston material), 20 soil types of 18 series are mapped. Oklalheha clay, Ruston fine sandy loam, and Pheba fine sandy loam predominate, occupying 17, 14.3, and 11.2 per cent of the total area, respectively.

**Increasing crop yields for war needs**, A. T. WIANCKO (*Indiana Sta. Circ. (1918), pp. 7, fig. 1*).—The necessity of increased production per acre rather than increased acreage under present conditions is emphasized. Such fundamental factors as good crop rotations, tile drainage of wet lands, liming, and the use of stable manure, crop residues, and commercial fertilizers are briefly outlined as the principal means of increasing yields.

**To fertilize is patriotic and profitable**, D. F. HUNTERFORD and W. E. ATRIES (*Arkansas Sta. Circ. 32 (1918), pp. 4*).—The results of fertilizer tests with cotton at 13 different places and with cotton at 8 places in Arkansas, covering 18 seasons during the period from 1908 to 1917 are summarized. The fertilizers used were cotton-seed meal, approximately 200 lbs. per acre, nitrate of

soda 100 lbs., acid phosphate 300 lbs., muriate of potash 50 lbs., and manure 7 tons, the same amounts being used whether the materials were applied alone or in combination.

The average yield of all unfertilized plots was 22.5 bu. of corn and 565 lbs. of seed cotton per acre. With acid phosphate the increased yield of corn was 0.7 bu., produced at a financial loss. The increase with nitrate of soda was 5.1 bu., valued at \$6.20, with cottonseed meal 4.4 bu., worth \$3.80, phosphate and nitrate 7.5 bu., worth \$7, complete fertilizer 8.6 bu., worth \$17.20, and manure 8.3 bu., worth \$16.60. For cotton the respective increases of seed cotton and estimated profits per acre were 62 lbs. and \$16.40, 86 lbs. and \$21.80, 100 lbs. and \$25, 104 lbs. and \$23.20, 134 lbs. and \$40.20, and 156 lbs. and \$46.80.

The results of fertilizer experiments with corn and cotton at the Alabama, Mississippi, and South Carolina stations are also briefly summarized and stated to corroborate the Arkansas results.

Recommendations are made regarding the use of fertilizers in 1918.

**Fertilizer experiments on DeKalb soils, J. W. WHITE (Pennsylvania Sta. Bul. 151 (1918), pp. 3-12, figs. 9).**—Based on work previously noted (E. S. R., 38, p. 219), permanent field experiments begun in 1916 are described which embrace a study of the effect upon depleted DeKalb soil abandoned for 40 years of various combinations of commercial fertilizers, limestones, and manure in a four-year rotation of corn, oats, wheat, and grass, and on permanent pasture land. The results of the first year's growth of clover and pasture grasses are noted in tabular form, together with the annual cost of the fertilizer treatments.

The use of mard phosphate and limestone resulted in a higher yield than lime and rock phosphate, although the latter was used in amounts four times that of the acid phosphate. When the same materials were used with manure the differences were less marked. A comparison of applications of various amounts of acid phosphate indicated that the yields were in the order of the amounts applied. An application of 600 lbs. per acre is deemed most economical for the first treatment.

**A ten-year study of the effect of fertilizers on the soluble plant food in the soil and on the crop yield, W. B. ELLIOTT and H. H. HILL (Virginia Sta. Tech. Bul. 13 (1917), pp. 46-72, fig. 1; Rpts. 1915-16, pp. 46-72, fig. 1).**—Chemical investigations and fertilizer experiments are reviewed which show that Virginia soils derived from different geological formations are deficient in available phosphoric acid and respond to available phosphatic fertilizers.

"Certain soil types containing large quantities of iron and alumina possess the power of retaining or fixing the phosphoric acid when applied in soluble forms. This fixation is as great in some soils as 95 per cent. The soils of the older geological formations possess the greatest fixing power, while those of more recent origin fix the least. The latter type has a fixing value of about 17 per cent.

"In cylinder experiments where the soils were fertilized with salts prepared in the laboratory, fifth-normal nitric acid failed to show the true availability of these salts as compared with the crop yields. When the soils from the plots were extracted with fifth-normal nitric acid . . . it was found that the  $P_2O_5$  increased with each annual application of phosphate from the three sources. Therefore the reserve supply of  $P_2O_5$  is being built up and it is reasonable to suppose that this reserve supply will continue to increase from year to year. It is shown that on soils of the Hagerstown series relatively the same amounts of  $P_2O_5$  are taken up by the plant or fixed by the soil regardless of whether the  $P_2O_5$  is applied to the soil in the form of acid phosphate, floats or Thomas slag. This is borne out by the average yields for nine years.

"From the results obtained on a plat receiving an annual application of 1,200 lbs. of lime, it is shown that the lime factor plays a more important part than would be expected on soils of this type."

**A study of the bacteriology of fresh and decomposing manure, T. J. MURRAY (Virginia Sta. Tech. Bul. 15 (1917), pp. 103-117, fig. 1; Rpts. 1915-16, pp. 103-117, fig. 1).**—"Samples were taken first of fresh and then decomposing manure at monthly intervals for a period of six months. The samples were plated on beef peptone agar, synthetic agar, and nitrogen-poor agar under aerobic and anaerobic conditions. The number of bacteria per gram was estimated on these media under these conditions. The percentage of facultative anaerobes was estimated by growing several cultures from the anaerobic plates under aerobic conditions. The percentage of organisms facultative in regard to nitrogen-poor and synthetic media was also estimated. From a high dilution plate of beef peptone agar, one on which there was approximately 100 colonies, all the bacteria were picked and inoculated on agar slants. These cultures were stained by the Gram method and run down through a series of physiological culture media; their chemical activities were studied and the organisms identified. The following things were noted:

"Higher counts were obtained on beef peptone agar than on any other medium. For the first four periods higher counts were obtained on Winogradskii nitrogen-poor media. Thereafter higher counts were obtained on synthetic media. Anywhere from 12 [million] to 43 million organisms per gram were found on beef peptone agar. There is no progressive increase or decrease throughout the six months. There are always, with one possible exception, the first month, more aerobes than anaerobes. The anaerobic count on beef peptone agar varied from 1,265,000 to 35,400,000 bacteria per gram. From 60 to 100 per cent of the anaerobes on beef peptone agar were facultative in regard to air. From 73 to 92 per cent of bacteria that developed on synthetic agar were facultative in regard to beef peptone agar. From 77 to 96 per cent of the bacteria that developed on Winogradskii nitrogen-poor media were facultative in regard to beef peptone agar.

"In the first month before any fermentation had taken place 63.5 per cent of the organisms isolated and studied were *Bacillus coli*. The remainder were very closely related. During the second month *B. coli* was present to the extent of 8 per cent. Thereafter it was entirely missing. After one month there is always a predominating type of bacterium, usually a gram-positive spore-forming, strepto-haemophilus. Usually there are more spore-forming bacteria than nonspore-forming organisms present. Ammonifying organisms are present throughout all the work. Every organism isolated formed ammonia from peptone. For the first two periods proteolytic bacteria are practically missing. Thereafter there is a progressive increase and during the last month practically all the bacteria are of this type. Denitrifying bacteria of two types are present, those that form nitrites from nitrates and those that form free nitrogen from nitrates.

"The type that forms nitrites from nitrates is present throughout. There is a progressive decrease from 100 per cent in the fresh manure to 50 per cent in the last sample of decomposed manure. The other type is present, with one exception, throughout. These organisms that give off free nitrogen are always in the minority, although in the period one month after the fermentation had started there were as many as 17 per cent present."

**Effect of nitrifying bacteria on the solubility of tricalcium phosphate, W. P. KELLEY (Jour. Agr. Research [U. S.], 12 (1918), No. 10, pp. 671-683).**—An account is given of a study made at Citrus Experiment Station, Cal., of the effects (1) of added calcium carbonate, tricalcium phosphate, and ammonium

sulphate on the solubility of calcium and phosphoric acid in a light sandy loam soil; (2) of nitrification of the soil nitrogen, ammonium sulphate, and dried blood on the solubility of the calcium and phosphoric acid naturally occurring in soils; and (3) of nitrification in soil and sand cultures on the solubility of tricalcium phosphate, both with and without the addition of calcium carbonate.

To portions of 2,000 gm. each of fresh soil (or sand) in half-gallon fruit jars a solution of ammonium sulphate was added at rates supplying 0.01 gm. of nitrogen per 100 gm. of dry soil; to other portions an equal quantity of nitrogen was added in the form of dried blood; to still other portions no nitrogenous substance was added. Tricalcium phosphate was added in certain cases at the rate of 0.1 gm. per 100 gm. of soil and calcium carbonate at the rate of 0.25 gm. per 100 gm. of soil. After a thorough mixing of their contents, adding suitable amounts of water and mixing again, the jars were loosely covered and incubated at room temperature. Tests were made immediately after the mixing of the materials, which served as a basis for correction for solubility in water and ammonium sulphate solution without the intervention of bacteria. The nitric nitrogen and water-soluble calcium and phosphoric acid were determined after incubation periods of 23, 57, and 157 days.

The results obtained showed that "the addition of calcium carbonate produced no effect on the immediate solubility of the soil calcium or that added as tricalcium phosphate. The addition of tricalcium phosphate produced an increase of about 5 parts per million of soluble calcium and 11.2 parts per million of soluble phosphoric acid, while the addition of ammonium sulphate brought about an increase in water-soluble calcium from 27.5 to 90.1 parts per million.

"Active nitrification of ammonium sulphate and dried blood took place in the soil series, and at the same time notable increases in soluble calcium were produced. No increase in the solubility in water of the soil phosphates or of tricalcium phosphate was produced by bacterial action except in the nitrification of ammonium sulphate when added without calcium carbonate. In this case 0.158 lbs. (70.8 gm.) of phosphorus were dissolved for every pound of nitrogen oxidized. . . . The addition of calcium carbonate brought about an increase in soluble calcium but tended to lower the solubility of tricalcium phosphate.

"In the absence of calcium carbonate the nitrification of ammonium sulphate in sand cultures was accompanied by the solution of theoretical amounts of tricalcium phosphate. When calcium carbonate was present, however, the solubility of tricalcium phosphate was not increased by nitrification. The formation of nitrite from dried blood took place more rapidly in the sand cultures than the formation of nitrate. Tricalcium phosphate was not dissolved by the nitrification of dried blood in the sand series. It was found that calcium carbonate promoted more active nitrification than tricalcium phosphate.

"The experimental results indicate that the nitrification of organic forms of nitrogen does not increase the solubility of rock phosphate under field conditions that are favorable to crop growth. It is possible, however, that the nitrification of ammonium sulphate may result in the solution of small amounts of tricalcium phosphate in soil low in carbonate."

Nine references to literature cited are given.

Pot experiments to determine primarily the availability of phosphoric acid in Thomas slag phosphates in comparison with other phosphates, W. B. ELLIOTT and A. A. INGHAM (*Virginia Sta. Tech. Bul. 16 (1917), pp. 118-136, figs. 9; Rpts. 1915-16, pp. 118-136, figs. 9*.)—This bulletin reports pot experiments made in cooperation with the Association of Official Agricultural Chemists.

"The soil used for these experiments was deficient in nitrogen, lime, and phosphorus in available forms. A comparison of the availabilities of the various phosphatic materials, as measured by crop yields, was made. The availability of the four slag phosphates was about equal . . . .

"As regards the slag phosphate no correlation is shown between the crop yield and the percentages of available phosphoric acid obtained by the 2 per cent citric-acid method of analysis. When sodium phosphate, double superphosphate, and acid phosphate are compared, their availabilities are seen to fall in the order named, which agrees with the analyses secured by the official ammonium citrate method. Where ground phosphate rock (floats) was used the crop yields obtained indicate that this material is of very little value in furnishing phosphoric acid on this soil type. No appreciable increase in the availability of this material was shown by the turning under of a legume crop."

*Phosphorus carriers in commercial fertilizers*, C. E. THORNE (*Mo. Bul. Ohio Sta.*, 3 (1918), No. 3, pp. 79-81, figs. 2).—A comparison of acid phosphate, dissolved boneblack, basic slag, and bone meal as phosphorus carriers in complete commercial fertilizers used in 3 and 5-year rotations at Wooster for 24 years, and in a 5-year rotation at Strongsville for 22 years, on both limed and unlimed soil, has led to the conclusion that, based on the total increase in yield of both grain and straw, and on the value of the increase from each treatment, the relative order of effectiveness with acid phosphate as 100 has averaged 92 for basic slag and 86 each for steamed bone meal and dissolved boneblack. Basic slag was slightly more effective on unlimed than on limed land, but not enough more to obviate the necessity for liming. The experiments are also held to indicate that no allowance should be made for the nitrogen carried by the bone meal.

*Availability of ground limestone of different degrees of fineness*, T. B. HUTCHESON, T. J. MURRAY, and T. K. WOLFE (*Virginia Sta. Rpts. 1915-16*, pp. 171-178, fig. 1).—In a study on greenhouse plots of red shale soil of the effect of limestone of different degrees of fineness (10 to 20 mesh, 40 to 60 mesh, 100 mesh, and equal parts of each size) on crop yield, nitrate formation, and number of bacteria in the soil, it was found "that the yield of rape and the number of bacteria increased as the fineness of limestone increased. The effect of limestone on nitrate production showed some variation. However, the inclosed areas in the plot which received the finest grade of limestone contained the highest amount of nitrates, and the inclosed areas of the check plot the least amount. It seems that when rape is grown on this type of soil the chief limiting factor in maximum production is lime."

*Report of analyses of samples of commercial fertilizers collected by the commissioner of agriculture during 1917* (*New York State, Sta. Bul. 440* (1917), pp. 523-584).—This reports the guaranteed and actual analyses of official samples of fertilizers and fertilizer ingredients collected during 1917.

#### AGRICULTURAL BOTANY.

*Methods of studying permeability of protoplasm to salts*, S. C. BROOKS (*Bot. Gaz.*, 64 (1917), No. 3, pp. 230-249).—Inclusive study (E. S. R., 37, p. 320) of methods heretofore employed to investigate the permeability of protoplasm to electrolytes, and of the evidences obtained by means of such methods, is claimed to have shown that apparent conflicts may be due in large part to imperfect understanding of the limitations of such methods or to unwarranted assumptions regarding the nature and reactions of living matter.

In this article, which is regarded as preliminary, the author confines himself chiefly to critical consideration of the methods previously employed, which are

said to fall into four general categories in which the criteria employed are chemical analysis of tissue extracts or of solutions bathing the tissues, visible changes within the cell, turgidity of cells or tissues, and electrical conductivity of tissues or of masses of cells. To these the author adds a diffusion method which is described in the paper noted below.

A new method of studying permeability, S. C. Brooks (*Bot. Gaz.*, 64 (1917), No. 4, pp. 308-317, figs. 2).—Having set forth in the paper above noted the desirability of a study of permeability by some method which should be independent of other methods and should yield data not depending for interpretation upon unverified assumptions, the author herein presents the method proposed by him, which is considered to fulfil such requirements. This method is claimed to have revealed errors previously made in the interpretation of data secured by different methods or in the validity of conclusions based upon such data.

The method as here detailed, with the results obtained therefrom, depends upon the diffusion of salts or other substances through a diaphragm of living tissue, satisfactory material for the purpose having been found in the fronds of *Laminaria agardhii* (*L. saccharina*). It is stated that the protoplasm of *Laminaria* is normally permeable to the salts of sea water. Salts of sodium cause an increase of permeability ending in death, and salts of calcium and lanthanum cause first a decrease and later an increase resulting in death.

Influence of hydrogen ion concentration of medium on the reproduction of alfalfa bacteria, E. B. Farn and N. E. Loomis (*Jour. Bact.*, 2 (1917), No. 6, pp. 629-635, fig. 1).—An attempt to study the effect of reaction (hydrogen ion concentration) on the growth of *Bacillus radicicola* has given data which show the difference between the concentration of hydrogen ions and the total concentration of acid or alkali. The change in the hydrogen ion concentration is much greater with increase in acidity than with corresponding increase in alkalinity, especially after bacterial growth has continued for two weeks. Plate counts after such period indicate that *B. radicicola* is much more sensitive to sulphuric acid in mannitol solution than to gram-equivalent amounts of sodium hydroxide. The growth for different species of legume bacteria in culture media of varying hydrogen ion concentrations is to be dealt with in a later paper.

The effect of different plant tissues on the fixation of atmospheric nitrogen, T. J. MURRAY (*Virginia Sta. Tech. Bul.* 15 (1917), pp. 93-102; *Ann. Repts.* 1915, 1916, pp. 93-102).—The dried and ground tissues of 21 different grasses, forage plants, and vegetables were added at the rate of 1 per cent in series of 300-gm. samples of silt loam and sand in 1-qt. glass jars and incubated at 28° C., nitrogen being determined immediately and after 2, 4, and 6-month intervals. All of the substances except three stimulated nitrogen fixation in the soil. Nine of them failed to show any stimulating effect and twelve only slight stimulation in sand.

The endotrophic mycorrhiza of Ericaceæ, J. DUFÉNOY (*New Phytol.*, 16 (1917), No. 8-9, pp. 222-228, figs. 4).—A study of *Arbutus unedo* is said to support the view that symbiosis with endophytes is a general rule for at least the Orchidaceæ and the Ericaceæ. It is claimed also that the so-called symbiosis is in reality a form of parasitism in which an equilibrium exists between the invading power of the fungus and the resisting power of the host, profitable to both so long as it is maintained but eventuating in disadvantage or death to either one if sufficient advantage is gained by the other symbiont.

The effect of certain rusts upon the transpiration of their hosts, J. E. WEAVER (*Minn. Bot. Studies*, 4 (1916), pt. 4, pp. 373-406, pls. 2, figs. 9).—Reporting results of experiments during 1914-15 with rust-infected and healthy

plants of 8 different species, of which the transpiration was measured for more than 200 individuals, the author states that without exception the presence of even a small amount of cereal rust accelerates decidedly the transpiration rate for a long period, beginning about the time that the pustules break through the epidermis. A very close quantitative relationship was established between the amount of pustular area and the increase in transpiration, but this is not held to be due wholly to the torn epidermal surface. It is thought that under conditions brought about by disease the transpiration rate might become so excessive as to hinder the normal activities of the plant.

Response of microorganisms to copper sulphate treatment, N. L. HUFF (*Min. Bot. Studies*, 4 (1916), pt. 4, pp. 401-425, figs. 5).—Noting the effect, as brought out by tests in 1915, of copper sulphate on microorganisms in Vadnais Lake, which furnishes water for the city of St. Paul, the author states that a concentration of 1: 12,000,000 is adequate for the elimination of *Spirogyra*, *Cyclotella*, and most of the *Cyanophyceæ*. A strength of 1: 10,000,000 is effective in destroying all the forms listed, with the possible exception of *Eudorina* and *Pandorina*. Such an application remains effective for about five weeks, after which time the organisms may increase with remarkable rapidity.

A new plant producing hydrocyanic acid, M. MIRANDE (*Compt. Rend. Acad. Sci. [Paris]*, 165 (1917), No. 21, pp. 717, 718).—The author claims to have demonstrated the presence of hydrocyanic acid in *Isopyrum thalictroides* and to have found the same acid along with other products in *I. fumarioides*. It is stated that this plant agrees with the rule to which a few exceptions exist in regard to plants producing cyanogen, namely, that there is a correspondence between the hydrocyanic acid content and the yellow color of the plant.

Fats from *Rhus laurina* and *R. diversiloba*, J. B. McNALLY (*Bot. Gaz.*, 64 (1917), No. 4, pp. 330-336, fig. 1).—The author attempted to ascertain whether the fats from *R. laurina* and *R. diversiloba* are identical with Japan wax, and to determine any connection existing between this fat and the poisonous properties of *R. diversiloba*. He reports that he obtained substances from ripe fruits of these plants resembling Japan wax more than any other fat, and that an increase in the fat content occurred coincidentally with a decrease in the toxicity of the ripening fruit, which decrease culminated in its becoming nontoxic. This final phenomenon is considered not to be due to a chemical transformation of the poison into fat, for reasons which are stated.

The excretion of acids by roots, H. COUPIN (*Compt. Rend. Acad. Sci. [Paris]*, 165 (1917), No. 17, pp. 564-566).—Having carried out a series of studies regarding the excretion of acids by roots, the author states that this is really the work, not of the root hairs, but of the superficial cells of the rootlet itself. This work is participated in by the portion between the root hairs and the root tip, also by the portions from which these processes have disappeared. It is stated also that this production of acid is more active at points of injury to the superficial cells of the rootlet.

On some criticisms of the osazone method of detecting sugars in plant tissues, S. MANGHAM (*New Phytol.*, 16 (1917), No. 8-9, pp. 236-240).—This is a reply to discussions by several persons of the author's report on the osazone method as previously noted (E. S. R., 34, p. 729).

The adaptation of Truog's method for the determination of carbon dioxide to plant respiration studies, A. M. GURJAR (*Plant World*, 20 (1917), No. 9, pp. 288-293, fig. 1).—In the preliminary work on respiration in the stored grain now being carried on by the author, it has become evident that the method of carbon dioxide determination must accomplish rapid removal of the carbon dioxide and must accommodate the wide variations met with in its amount without materially impairing accuracy. The author describes the arrangement

and operation of the apparatus which has been worked out with these ends in view, and which is considered to satisfy these requirements, as it has been used with very satisfactory results.

Observations on the influence of aeration of the nutrient solution in water culture experiments, with some remarks on the water cultural method, W. STILES and I. JÖRGENSEN (*New Phytol.*, 16 (1917), No. 8-9, pp. 181-197).—In a review of the development and the employment of the water culture method of measuring growth in plants during the past, the authors emphasize the complexity of the problems encountered in this work, illustrating this feature in relation especially to aeration. Agreements and differences are noted between the work of the authors (E. S. R., 33, p. 521; 36, p. 731), and that of other investigators.

It is held that water culture conditions react in a different manner on different species. The attainment of definiteness requires much work on the physical chemistry of water cultures, and investigation needs to be extended as regards the dynamical principles involved. The cooperation of the various activities of the plant must be recognized as a factor. It is regarded as desirable that a working principle in regard to the physiological relations of plant processes be evolved which may embody the activities of both sub-aerial and subterranean parts of the plant.

The physiological requirements of wheat and soy beans growing in sand media, A. G. McCALL (*Proc. Soc. Prom. Agr. Sci.*, 37 (1916), pp. 48-59, figs. 5).—The author has carried out the preliminary portion of a general plan for the study of the fertilized requirements of farm crops at the Maryland Experiment Station. The pots used and the method of manipulation have been described previously (E. S. R., 36, p. 212). The medium employed was the three-salt solution used by Shive (E. S. R., 34, p. 333).

Wheat and soy beans were studied during the first 24 days of their growth, and the data are given in tabular and graphical form, showing among other facts that the proportions of nutrient salts which gave the highest growth rate for wheat also gave the highest rate for soy beans. It appears also that the total loss from transpiration is proportional to the growth rate of the plant during the given time (within the limits here employed).

A feature considered as important is the regularity with which both the growth curve and the transpiration curve rise in correspondence with an increase of calcium nitrate and a decrease of magnesium sulphate.

This study is to be extended to other important field crops.

The interpretation and application of certain terms and concepts in the ecological classification of plant communities, G. E. NICHOLS (*Plant World*, 20 (1917), Nos. 10, pp. 305-319; 11, pp. 341-353).—The author has attempted to work out a logical and adequate, yet simple and somewhat elastic, scheme of ecological classification readily adaptable to employment for the vegetation of any given region, the groundwork for such a classification being afforded by the principle of succession.

The fundamental unit of vegetation is the association. The associations of a unit physiographic area constitute an edaphic formation. The edaphic formations of a unit climatic area, taken collectively, constitute a climatic formation. The climatic formations of the earth constitute the terrestrial formation. The association is determined by habitat, the edaphic formation by physiography, the climatic formation by climate, and the terrestrial formation by the atmosphere. These are synoptically arranged, and the employment of the scheme in practice is partly illustrated as applied to the vegetation of northern Cape Breton Island.

Root systems of certain desert plants, M. S. MARKLE (*Bot. Gaz.*, 64 (1917), Vol. 3, pp. 177-205, figs. 53).—The author has carried out a study of root systems in the region near Albuquerque, N. Mex., which presents certain contrasts with that near Tucson, Ariz., studied by Cannon (E. S. R., 26, p. 728). In his report herein noted he has employed that author's classification of root systems.

The region around Albuquerque has a lower rainfall and winter temperature than prevail in that around Tucson. The soil is fluviatile and diverse as regards composition, somewhat lacking as regards the hardpan layer development noted at Tucson, also as regards the winter annuals and the larger shrubs and cacti, most of the plants being perennial herbs. The roots usually penetrate rather deeply, but they often show prominent intervals near the surface. Cacti and some shrubs have very superficial root systems, the larger cacti showing differentiation into anchorage and absorptive roots. Plants on the banks of arroyos may have prominent tap roots corresponding in length to the height of the plant above the arroyo bottom. Storage roots are uncommon except in the moister situations. Vegetative reproduction from roots is common in unstable soil. Variation in penetrability and in moisture content of soil are two influential factors in root variation. The roots of the plants of an association are grouped into rather definite layers, the result of which is to lessen the root competition by which the composition of an association is supposedly determined.

Cryoscopic determinations on tissue fluids of plants of Jamaican coastal deserts, J. A. HARRIS and J. V. LAWRENCE (*Bot. Gaz.*, 64 (1917), No. 4, pp. 285-305).—The authors have regarded the physicochemical properties of vegetable saps as important in ecology and phytogeography for reasons detailed in a paper previously noted (E. S. R., 36, p. 823), and have found conspicuous differences in osmotic concentration between the tissue fluids of plants in the Tucson and in the Cold Spring Harbor regions (E. S. R., 33, p. 623). They have selected for comparison with these areas the forested region of Jamaica described by Shreve (E. S. R., 32, p. 748), and studied this during the winter and spring of 1915, obtaining data some of which are reserved for future publication. The present paper contains the results of freezing-point determinations of tissue fluids of plants of this region and comparisons thereof with those from other regions, with tentative suggestions regarding the causes of peculiarities observed.

Taken as a whole, the species here considered show tissue-fluid concentrations as high as, or higher than, those of fairly comparable growth forms in the Arizona deserts, the concentrations of the leaf saps of ligneous forms averaging two or three times as high as those in mesophytic regions. Plants of rocky slopes here show higher concentrations than do those of rocky slopes of the Arizona deserts, but their constants are decidedly lower than those of the coastal flats. The sap of the cacti is much less concentrated than is that of the hard or succulent leaves of the trees and half-shrubs among which they stand. Suggestions are offered regarding the causes of the differences observed.

Leaf structure as related to environment, H. C. HANSON (*Amer. Jour. Bot.*, 4 (1917), No. 9, pp. 533-560, figs. 21).—This is a study of the developmental differences observable between leaves growing in full sunshine at the south periphery of different trees and those growing in the crown of the same trees.

The origin and development of the Composite.—II, The pollen-presentation mechanism, J. SMALL (*New Phytol.*, 16 (1917), No. 8-9, pp. 198-221, figs. 4).—The styles of the Composite are said to be reducible to 14 types, the stamens to 16. In discussions given of the appendages in connection with their functions, the phylogenetic significance of both styles and stamens is also discussed.

An attempt to modify the germ plasm of *Onoclea* through the germinating seed, R. T. HANCE (*Amer. Nat.*, 51 (1917), No. 609, pp. 567-572).—Seeking to find chemicals capable of modifying the structure of the germ plasm or of bringing about irregularities in the distribution of the chromosomes, the author experimented in a preliminary way with pedigree seeds of *O. biennis* and with seedlings soaked for varying periods in different solutions.

It is stated that up to this time these treatments have on the whole resulted in a reduction of the percentage of germination or in a general weakening of the plants rather than in specifically modifying the germlinal constitution, though the desirability of further work is indicated.

On the distribution of abnormalities in the inflorescence of *Spiraea vanhouttei*, J. A. HARRIS (*Amer. Jour. Bot.*, 4 (1917), No. 10, pp. 624-636, *pls.* 2, *figs.* 4).—This paper illustrates the chief types of variation noted as occurring in the inflorescence of *S. vanhouttei*, giving the results of studies on the distribution of these abnormalities. It is stated that the distribution of abnormal pedicels among the inflorescences gives a one-sided or skew frequency distribution curve, in which the frequency of occurrence shows a variation opposite in its character to that of the frequency of abnormal pedicels.

Observations on *Betula* in Minnesota with special reference to some natural hybrids, C. O. ROSENDAHL (*Minn. Bot. Studies*, 4 (1916), pt. 4, pp. 443-459, *pl.* 1, *figs.* 2).—This includes evidences bearing upon the probable history of some natural *Betula* hybrids, with a key to the different forms discussed.

Studies of the Schweinitz collections of fungi.—I, Sketch of his mycological work; II, Distribution and previous studies of authentic specimens, C. L. SHEAR and N. E. STEVENS (*Mycologia*, 9 (1917), Nos. 4, pp. 191-204, *pls.* 2; 6, pp. 333-344).—The first of these articles gives a sketch of Schweinitz's mycological work, and the second the distribution and previous studies of authentic Schweinitz specimens.

Taxonomic characters of the genera *Alternaria* and *Macrosporium*, J. A. ELLIOTT (*Amer. Jour. Bot.*, 4 (1917), No. 8, pp. 439-476, *pls.* 2, *figs.* 11).—Concluding a study of various members of these two genera, the author gives his views regarding the relationships of different members, the environmental production of differences, and the significance of age and morphology in the description of species.

New species of *Peridermium*, G. G. HEDGECOCK and N. R. HUNT (*Mycologia*, 9 (1917), No. 4, pp. 239-242).—A description is given in this paper of 5 new species of foliicolous *Peridermium* on pine in the eastern portions of the United States, namely, *P. ipomoeae* on *Pinus echinata*, *P. palustris*, *P. rigida*, and *P. teda*; *Peridermium terebinthaceae* on *Pinus echinata*, *P. teda*, also possibly on *P. pungens* and *P. virginiana*; *Peridermium helianthi* on *Pinus virginiana*; *Peridermium fragile* on *Pinus palustris*, *P. teda*, and *P. rigida*; and *Peridermium minutum* on *Pinus glabra* and *P. teda*.

Notes on new or rare species of Gasteromycetes, W. H. LONG (*Mycologia*, 9 (1917), No. 5, pp. 271-274).—The author describes, as collected in Texas, the new genera *Geasteroides* and *Arachniopsis*, represented respectively by the new species *G. texensis* and *A. albicans*; *Laetareia columnata*; and a form provisionally described as *Lysurus texensis* which it is thought may prove to be only a red form of *Anthurus borealis*.

#### FIELD CROPS.

Green manure crops in southern California, W. M. MERTZ (*California Sta. Bul.* 292 (1918), pp. 3-31, *figs.* 7).—This bulletin reports the results of experiments conducted during 1910 to 1915, inclusive, on the relative effect of differ-

ent leguminous and nonleguminous green-manure crops as indicated by the yields of field crops following, notes experiments in progress since 1907 with green-manure crops in a citrus orchard, and presents a general review of experimental and observational data on the subject of green manuring.

Leguminous green-manure crops were grown during the winter in annual rotations with corn, potatoes, cabbage, beets, and sorghum and Sudan grass for hay, and included *Vicia sativa*, *V. atropurpurea*, *V. crvila*, *Medicago hispida denticulata*, *Pisum arvense*, *Lathyrus tingitanus*, *Melilotus indica*, *Trigonella foenum-gracum*, and *Lens esculenta*. The same nonleguminous green-manure crop (barley, alfalfa, or rye) was grown each year on alternate plats with the leguminous crops. Nitrogenous fertilizers were also applied to certain of the nonlegume plats consisting of from 270 to 1,080 lbs. of nitrate of soda per acre from 1910 to 1913, inclusive, and from 300 to 1,200 lbs. of dried blood per acre during 1914 and 1915. The yields of the leguminous green-manure crops varied from 7.5 tons per acre for *P. arvensc* to 20 tons for *V. atropurpurea*, with an average yield for the nine legumes tested of 13 tons as compared with an average yield of 9.7 tons per acre from the eight nonlegume plats. *M. indica* was deemed the most promising of the leguminous crops, while common vetch, bur clover, and Canada pea gave satisfactory results. Rye and barley both gave heavy yields in time for spring plowing.

The field crops grown on the legume plats showed average increases over those grown on the nonlegume plats amounting to 14 bu. of corn per acre, 62 bu. of potatoes, 2.5 tons of cabbage, 6 tons of beets, and 1 ton of sorghum and Sudan grass hay, an average increase for all crops of 37.7 per cent. Applications of nitrogenous fertilizers to nonlegume plats resulted in an average increase in yield of all field crops of 30 per cent, but the value of the increase failed to cover the cost of the fertilizers except with cabbage and potatoes. The nonlegume plat receiving the greatest amount of nitrogen (163 lbs. per acre) showed an average increase of 51 per cent, while the plat sown to *M. indica* showed an increase of 57 per cent.

Observations on the effect of leguminous green manures on citrus trees indicated that the trees on the green manured plats were superior in every way to those on plats similarly fertilized but where no green manure had been used, the results being measured in terms of yield, grade and size of fruit, size of tree, and estimated amount of "mottled leaf." Green manuring resulted in an increase of 68 per cent in total yield, 30 per cent in size of tree, and 63 per cent in desirable sized fruit. Only 3 per cent of the leaves were mottled during the seasons of 1912 to 1914, inclusive, on the leguminous green-manure plats as compared with 13.5 per cent on plats not so treated.

Field methods in growing leguminous green-manure crops are outlined.

Beans in Colorado, A. KEZER (*Colorado Sta. Bul. 234 (1918)*, pp. 3-22, figs. 9).—A revision of Bulletin 226 (E. S. R., 37, p. 232).

The effect of hybridization on maturity and yield in corn, T. B. HUTCHESON and T. K. WOLFE (*Virginia Sta. Tech. Bul. 18 (1917)*, pp. 161-170; *Rpts. 1915-16*, pp. 161-170).—This reports the results of experimental work planned to study the effect of hybridization of varieties of corn on maturity and yield in the *F<sub>1</sub>* generation. In 1915 crosses were made between Reid Yellow Dent and Gold Standard as the pollen parents and Boone County White, Shenandoah County White, and Johnson County White as the seed parents. In 1916 four series were planted with the five parent varieties and the six hybrids, there being four rows of 20 hills each of each variety and hybrid in each series. Daily observations were made from time of tasseling until silking was complete, the time of tasseling and silking obtained for each plant, and the time of maturity for each row. The data are tabulated and discussed.

It was concluded that there was a marked earliness in the time of maturity of some hybrids as compared with their parents while with others the increase was not so marked, although in every case the hybrids matured earlier than their parents when the average time of maturity of the latter was taken as a basis for comparison. An increase in yield in the  $F_1$  hybrids accompanied earlier maturity, this being especially marked in the Johnson County White+Gold Standard cross.

Anomalous seed in *Ze a mays*, T. K. WOLFF (*Virginia Sta. Rpts. 1915-16*, pp. 193-199, *figs. 2*).—Supplementing his previous observations (E. S. R., 36, p. 335) on two fasciated kernels of maize and their  $F_1$  progeny, the author presents a brief discussion of the  $F_2$  progeny. Pure and hybrid seed produced by each connate kernel in the  $F_1$  generation were planted in alternate rows and allowed to open pollinate. Among the  $F_2$  progeny were kernels with the embryo facing the base of the ear and with the embryo on the left and right side, respectively, although in a majority of the kernels the embryo faced the tip of the ear. Connate seed and two-seeded spikelets also occurred.

A tabular statement is presented showing the number of different kinds of kernels produced by different ears, the data indicating wide variations in the ratio of abnormal to normal kernels. "However, it seems that there is a tendency for connate seed to be inherited. The occurrence of kernels with the embryo placed other than in the normal way is unusually frequent."

The author reports having observed a third connate kernel on an ear borne on Shenandoah County White pollinated with mixed pollen from that variety and Reid Yellow Dent. This kernel failed to show any yellow color and differed from those previously described by him in that there was a partial union of the two kernels occurring at the crowns and along the lower halves of the kernels. They are further described as more or less three-cornered in shape, placed back to back, and as having two embryos but on opposite sides. Two connate kernels were also found on different ears of Silver King and one on an ear of Boone County White.

Summary report on varieties of cotton in 1916, W. E. AYRES (*Arkansas Sta. Circ. 29*, pp. 4).—An abridgement of Bulletin 129 (E. S. R., 37, p. 622).

Fertilizers for Japanese cane, J. M. SCOTT (*Florida Sta. Bul. 144* (1918), pp. 91-98).—Supplementing work previously noted (E. S. R., 34, p. 831), the results of fertilizer experiments with Japanese cane are reported for 1914, 1915, and 1916.

The highest average yield, 19.8 tons of green material per acre, was obtained from the use of 30 two-horse wagon loads of barnyard manure as compared with a yield of 5.6 tons from untreated checks. The best results with complete fertilizer were obtained with 84 lbs. of sulphate of ammonia, 150 lbs. of acid phosphate, and 60 lbs. of sulphate of potash, with 2,000 lbs. of ground limestone per acre, showing an average yield of 13.7 tons per acre. When only two plant food elements were applied, the best yields were with 84 lbs. of sulphate of ammonia and 60 lbs. of potash per acre, 9.1 tons. Nitrate of soda at the rate of 116.6 lbs. per acre showed the best results for any one single element, a yield of 9 tons. With Thomas slag, acid phosphate, and raw rock phosphate the yields were 6.8, 5.8, and 4.9 tons per acre, respectively, when used singly, although little difference in the values of acid and rock phosphate could be observed when used in complete fertilizers. Applications of 123.5 lbs. of dried blood, 116.6 lbs. of nitrate of soda, and 84 lbs. of sulphate of ammonia per acre resulted in yields of 5.4, 9, and 7.2 tons, respectively. An application of 2,000 lbs. of ground limestone with 84 lbs. of sulphate of ammonia resulted in an average yield of 7.6 tons per acre.

**Peanut culture, E. T. BATTEN** (*Virginia Sta. Bul. 218 (1918)*, pp. 3-16, fig. 1).—This presents a general discussion of field practices and cultural methods recommended for peanut growing in Virginia. It is stated that "the production of this crop may be greatly increased by better cultured methods, good systems of crop rotation, and fertilization." Experimental results are briefly noted which are held to indicate that peanut soils should be limed once in four years with 1,000 lbs. of burnt lime or 2,000 lbs. of ground limestone, and should receive each year from 200 to 400 lbs. of acid phosphate per acre applied in the row at planting time.

In a comparison of Jumbo, Virginia Runner, Virginia Bunch, and Spanish showing the number of nuts per pound, the relative loss in shelling was found to be 33.33, 14.7, 26.92, and 17.74 per cent, respectively. These same varieties grown at Hollins during the season of 1917 produced 1,080, 1,050, 975, and 675 lbs., of nuts per acre, respectively.

The cost of growing the crop has been estimated to be about \$32.25 per acre and the value of the crop with a yield of 40 bu. per acre to be \$74.80.

**Growing sorghum in Kansas, C. C. CUNNINGHAM and R. KENNEY** (*Kansas Sta. Bul. 218 (1917)*, pp. 1-54, figs. 2-5).—Approved cultural methods and field practices for growing grain and forage sorghum in Kansas are described, the relative value of sorghums and corn for Kansas conditions discussed, and variety tests with sorghums for grain and forage noted. The sorghums proved to be more resistant than corn to heat and drought and outyielded corn as a forage or silage crop in all parts of the State.

On fertile bottom lands with an annual precipitation of about 30 in., sweet sorghum, Kafir corn, and corn grown for silage showed average yields for a five-year period of 18.02, 11.88, and 11.81 tons per acre, respectively. On infertile soil and in drier parts of the State the respective yields for a three-year period were 12.3, 9.6, and 8.4 tons per acre.

Although sorghum leaves the ground in poor condition for other crops pound for pound of material produced it is said not to deplete soil fertility more than any other crop. Where suitable, late planted crops, such as corn, cowpeas, soy beans, millet, or sweet clover, are recommended for use after sorghum, while in western Kansas fallowing or partial fallowing may be practiced followed by winter wheat.

Varieties of grain sorghum deemed best include Blackhull Kafir for favorable conditions, Pink Kafir for poor soils, unfavorable seasons, or short, late growing periods, and Dwarf milo, feterita, and other early varieties for seasons too short or too dry for Pink Kafir. For forage, Red Amber is said to be specially suited to western Kansas and Kansas Orange and an early strain of Sumac to eastern Kansas.

Of the three planting methods generally employed in the State, surface planting is deemed best for the heavy, poorly drained soils of eastern Kansas, the open furrow method for the well-drained soils of eastern Kansas where rainfall is abundant, and listing for western and central Kansas. Fall listing is regarded as a good farm practice in the western part of the State.

Several feeding experiments reported are abstracted on page 71.

Diseases and insect enemies affecting the crop are briefly described and control measures indicated.

**Report of the plant breeder, H. B. COWGILL** (*Porto Rico Dept. Agr. Sta. Rpt. 1917*, pp. 15-26, 29-36, figs. 6).—This reports the progress of sugar cane breeding work and of fertilizer experiments with sugar cane conducted at the Porto Rico Insular Station for the year ended June 30, 1917, in continuation of work previously noted (E. S. R., 37, p. 236).

The cross pollination of cane varieties was continued employing the method described in the last report, the standard varieties Otaheite and Crystallina again being used as the pistillate parents, and the pollinators being B-347, B-3412, B-109, B-4596, D-117, and D-109. The results are said to have been successful, both from the point of view of technique and as to the number of seedlings produced. Different grades of cloth for haggling the tassels were tested and a closely-woven cheesecloth was found to be most suitable. "The work during the past year tends to verify the belief that some of the characters of cane can be combined by breeding as has been done with other plants. The seedlings from crossed seed appeared to grow stronger and to possess a greater degree of vigor than those from uncrossed seed planted alongside."

Selections were made from the 1912, 1913, 1914, 1915, and 1916 seedlings for propagation and further selection. Brief descriptions are presented of the 10 most promising new varieties developed on the island from selected 1912 seedling canes. Tests of foreign seedlings are also reported in which D-117 and B-3412 are said to have given the best results as compared with Otaheite.

In the fertilized experiments conducted at the station the limed and fertilized plots produced much higher yields than those similarly fertilized but unlimed. The maximum yield, 24.1 tons, of cane per acre was obtained from a limed plot fertilized at the rate of 120 lbs. of nitrogen, 120 lbs. of potash, and 60 lbs. of phosphoric acid per acre. Cooperative fertilizer experiments are also described in which the highest yields were obtained from an application of 120 lbs. of ammonia, 60 lbs. of phosphoric acid, and 60 lbs. of potash per cuerda (1.01 acres), amounting to approximately 20.15 tons of cane. A tabular statement is presented showing the estimated cost of the various fertilizer treatments and the value of the increase in yield of cane per cuerda. The experiments are said to indicate "that it is economy to use fertilizer, even at the present price, but that the proportion of nitrogen should be relatively high and that of potash relatively low, or entirely omitted."

**Effect of some alkali salts upon fire-holding capacity of tobacco, H. R. KRAYBILL (Bot. Gaz., 64 (1917), No. 1, pp. 42-56).**—The conflicting theories of Schlossing, Nessler, Garner (E. S. R., 19, p. 334), Mayer, and Barth with respect to the reasons for the favorable action of the potassium salts of organic acids upon the "burning qualities" of tobacco are briefly reviewed. The author then presents and discusses his own experimental data showing the effects of caesium, rubidium, potassium, sodium, and lithium salts in an effort to obtain further light upon these theories. It was suggested that the different salts may affect the colloidal state of the material of the leaf, or that potassium may possess some peculiar chemical properties which account for its behavior.

The method of experimentation involved the treating of tobacco leaves, filter paper, and lump sugar with the various salts and noting their effect upon the fire-holding capacity. The tobacco was all of a strain of a cigar filler type grown in Pennsylvania under definite fertilizer treatments. The leaves had been well sweated. All the salt solutions applied were 28.9 per cent of normal. In studying the effect of the salts upon the colloidal state of the leaf materials some leaves were rendered acid by treatment with 0.5 normal acetic acid and others rendered alkaline by a treatment with 0.2 normal sodium hydroxid. The salts were applied by means of an atomizer and the leaves placed under bell jars to allow a diffusion of the salts through the leaf. Portions of the tip, middle, and base of each leaf were tested for fire-holding capacity, being timed with a stop watch. The author's observations and conclusions may be summarized as follows:

The alkali carbonates of caesium, rubidium, and potassium in the order named showed a definite, marked effect in promoting the fire-holding capacity

of tobacco, while sodium and lithium carbonates did not. Potassium oxalate was the only effective oxalate tested. Of the carbonates and oxalates tested in an alkaline medium lithium was more effective than sodium in the precipitation of colloids and was also slightly more effective in increasing the fire-holding capacity. The citrates showed no such relationship, and of the carbonates potassium, rubidium, and caesium did not behave in this manner. It is doubted, therefore, whether the effect of the salts upon the colloidal state of the tobacco leaf is significant.

Potassium citrate promoted burning, while the citrates of sodium and lithium were nearly neutral in their effect.

The organic salts of potassium, potassium carbonate, tripotassium phosphate, dipotassium phosphate, and potassium sulphate improved the fire-holding capacity, while potassium chloride, acid potassium sulphate, and monopotassium phosphate were injurious to the burn.

Sodium carbonate improved the fire-holding capacity slightly, while all other sodium salts were either neutral or injurious.

Data were obtained which failed to confirm the theory that reduction of the potassium salts accounted for their favorable action. Other data showed that the harmful effect of the chlorides was not due to their fusion as suggested by Barth. It was also evident that the alternate giving off and taking up of carbon dioxide did not account for the beneficial effect of potassium carbonate.

The author concludes that the effect of the salts in raising the temperature of the leaf may be significant, and that the action of caesium, potassium, and rubidium salts may be due to a number of complex factors. It is also deemed probable that caesium, potassium, and rubidium as carbonates, sulphates, and phosphates possess a specific catalytic action in combustion, and that the chlorides possess a negative catalytic action.

It is proposed to study the rate of decomposition of various organic salts of the alkalis and the decomposition products of various organic substances treated with salts of the alkalis when subjected to temperatures which are attained in the burning cigar.

A brief bibliography is appended.

Shall we plant more spring wheat? W. L. BUELISON (*Illinois Sta. Circ. 214 (1918)*, pp. 2).—The possibility of increasing spring wheat production in Illinois, especially in the northern and central part of the State, is indicated, and cultural methods are briefly described. Marquis, with 3-year average yields of 32.2 bu. per acre at DeKalb and 24.2 bu. at Urbana, is especially recommended; while Durum, Red Fife, and Bluestem are also regarded as valuable varieties.

Respiration of stored wheat, C. H. BAILEY and A. M. GURJAE (*Jour. Agr. Research [U. S.]*, 12 (1918), No. 11, pp. 685-715, figs. 7).—Briefly defining respiration "as the release of energy through the biochemical oxidation of organic compounds as accelerated by certain enzymes," the authors describe rather extensive investigations conducted at the Minnesota Experiment Station on the respiration of stored wheat and on the consequent heating of the grain.

"Since the grain itself is a poor conductor of heat, it follows that the heat energy released through respiration accumulates in the mass in proportion to its bulk, so that the increase in temperature may in time become very marked." All available evidence is held to indicate that the heat of respiration is produced by the oxidation of reducing sugars, that the principal release of energy should occur in the structure where it is required for the synthesis of new organic compounds, and that the embryo being endowed particularly with that function, respiration must be most pronounced in it, if not confined to it.

The procedure followed and the apparatus employed have been described elsewhere, as noted on page 27. The respiration data, stated in terms of milligrams of carbon dioxid respired per 24 hours by each 100 gm. of dry matter, are presented in tabular form, illustrated graphically, and fully discussed. The rate of respiration was studied with relation to various factors, including the moisture content of the grain, the consistency of the wheat kernel, the relative plumpness and soundness of the kernel, the "period of dampness" or duration of exposure to excess moisture in the wheat, the influence of temperature, the influence of accumulated carbon dioxid, and the effect of respiration in an oxygen-free atmosphere.

The results of the investigations are said to support the findings of other workers "that spontaneous heating in damp grain is occasioned by the biological oxidation of dextrose and similar sugars, chiefly in the germ or embryo of the kernel." It was concluded further that moisture is one of the determining factors in respiration, establishing the comparative rate of diffusion between the several kernel structures. Any gain in the moisture content of the kernel increased the rate of diffusion and, simultaneously, the rate of respiration, the increase being gradual and fairly uniform until the moisture exceeded 14.5 per cent, in the case of plump spring wheat, when it was markedly accelerated.

The soft, starchy wheats respiration more rapidly than hard, vitreous wheats containing the same percentage of moisture. Plumpness of the wheat kernel affected the rate of respiration, as shown by contrasting plump and shriveled grain. The shriveled wheat respiration two to three times as much as did the plump wheat at moisture contents above 14 per cent, while at percentages of moisture below 14 per cent the difference was not very marked. The high acceleration of respiration in shriveled wheat containing more than 14 per cent of moisture was attributed to the higher ratio of germ to endosperm and hence the larger percentage of enzym to substrate as compared with plump wheat.

The period of dampness bore a relation to the rate of respiration, as shown by comparing the respiration of freshly dampened wheat with that of naturally damp grain and with grain that had been dampened and stored for varying lengths of time. The curve of respiration diverged from that of freshly dampened wheat when the moisture content exceeded 12 per cent, and was more marked with 13 per cent of moisture. In the case of wheat dampened and stored, the quantity of carbon dioxid respired varied directly with the number of days the wheat remained in storage. The temperature at which the grain was stored affected the rate of diastatic action, thus increasing the quantity of substrate available to the respiratory enzymes, as indicated by the greater rate of respiration of wheat stored at room temperature than that stored at the outdoor temperature during the winter months.

Unsoundness of wheat caused by the freezing of the unripe plant resulted in higher respiratory activity in the thrashed grain, as was shown by comparing moderately and badly frosted wheats with sound wheat. The frosted wheat respiration more vigorously than the sound wheat, this being attributed to the arresting of the synthetic processes on freezing and subsequent activities of the hydrolytic enzymes on thawing of the frozen wheat. The accumulation of glucose as the result of starch hydrolysis furnished larger quantities of substrate to the respiratory enzymes.

Increasing temperatures accelerated the rate of respiration until 55° C. was reached. With rising temperature the diastatic action upon starch increased until a point was reached at which enzym activity diminished. Accumulation of carbon dioxid in the respiration chamber decreased the rate of respiration. The mean rate by four-day intervals was highest for the first four days, diminishing

materially in successive periods. Respiration was reduced in an oxygen-free atmosphere, the ratio to that occurring in a normal atmosphere being about 1:2.5.

A bibliography of 49 titles is appended.

The dandelion in Colorado, B. O. LONGYEAR (*Colorado Sta. Bul.* 236 (1918), pp. 8-35, figs. 21).—The appearance and habit of growth of the dandelion (*Taraxacum officinale*), said to be the most noticeable and persistent weed in lawns in Colorado and also reported as a rather important field weed in native pasture lands below 8,000 feet elevation, are described, and experimental work in an effort to effect its eradication and control is noted and fully discussed.

Germination tests with seed collected the fourth day after the first opening of the blossoms and on each successive day up to and including the ninth day indicated that at least seven days must elapse before any appreciable amount of seed is sufficiently mature to germinate. The maximum germination observed amounted to 25 per cent and the minimum to 8.3 per cent.

Based upon experimental results and upon general observations the following methods, or combination of methods, are deemed adequate for the control of the weed: (1) The establishment of lawns on a well-prepared seed bed and with good seed containing 10 per cent of white clover. Dead spots and thin places on the sod of old lawns should be reseeded each year, preferably in the early spring. (2) The application of about one teaspoonful of gasoline or kerosene to the crown of each plant at any time during the growing season. (3) The digging out of individual plants as deeply as possible and at least once each season, preferably just before blooming. A second digging in the fall is recommended. (4) The prevention of seeding by early digging, the use of gasoline on individual plants, frequent clipping, picking the flower heads while in bloom, and by early spraying with a suitable herbicide. (5) Spraying badly infested lawns with a solution of iron sulphate (1.25 lbs. per gallon) at least three times at intervals of about two weeks preferably in late summer was found to be most effective and was also the cheapest method from the standpoint of labor costs.

The dandelion did not crowd out alfalfa under favorable conditions of growth for the alfalfa, some limiting factor being present wherever an encroachment of the weed was noted.

Johnson grass control, H. C. HEARD (*Arizona Sta. Bul.* 82 (1917), pp. 333-355, figs. 11).—Experimental work on the eradication and control of Johnson grass (*Sorghum halepense*) in the irrigated valleys of southern Arizona, as outlined by J. F. Nicholson, is described, and tabulated data are presented showing the estimated cost and returns from the various treatments from July, 1915, to November, 1917. The experiments were conducted on the Salt River Valley Farm near Mesa, one-half of the tract being described as infested with a perfect stand of Johnson grass and about 40 per cent of the remainder heavily infested. The methods of treatment embraced summer fallow followed by winter grain, summer pasture with sheep followed by winter grain, intensive cultivation employing a rotation of cotton and corn, and continuous dry fallow. The fields varied in size from 10 to 40 acres. The different operations are discussed in detail and conclusions reached as follows:

"The quickest way to rid land of Johnson grass is to overgraze with sheep, meanwhile irrigating frequently. The most effective way, as well as the most economical, is the frequent cultivation of a late summer crop, such as corn, followed by another crop demanding much tillage, such as cotton. The exact crops to be chosen should depend upon the market outlook and the probable price which can be realized. The method demanding the least labor and out-

lay of cash in dry fallow in summer followed by winter grains. This system may be very profitable when grain prices are high."

**Seed Reporter** (*U. S. Dept. Agr., Seed Rptr.*, 1 (1918), No. 6, pp. 4).—A further report on the war emergency seed survey of January 31 is presented showing the total receipts and stocks on hand for January 31, 1918, and earlier dates, of 38 kinds of vegetable seed and 17 kinds of field seed, including clover, alfalfa, grasses, rape, and corn. The cooperative arrangements made by the Seed Stocks Committee of this Department with the U. S. Food Administration Grain Corporation for supplying spring wheat seed are outlined.

The sweet potato outlook is discussed in detail. Aside from the general shortage of seed sweet potatoes, large quantities of potatoes that were apparently sound are said to have been of doubtful quality and unfit for seed. Tabulated statistics are presented showing the stocks of registered seed of Irish potatoes in eight States inspected by this Department in the bin or storage cellar during 1917 and found to comply with certain requirements as to uniformity in size, trueness to type, relative freedom from varietal mixture, and both external and internal evidences of disease. Additional data show the stocks of seed certified by State organizations in five States.

Brief notes are presented on the velvet bean, navy bean, and sweet sorghum seed situations.

#### HORTICULTURE.

**Report of the horticultural department**, C. G. WOODBURY (*Indiana Sta. Rpt. 1917*, pp. 41-47).—The results of the long-continued orchard management investigations, here summarized, have been previously noted (*E. S. R.*, 38, p. 641).

During the past year greenhouse investigations have been conducted in the application of carbon dioxide to soils growing Christmas peppers, head lettuce, radishes, and string beans. As here briefly summarized, carbon dioxide appears to have beneficial as well as detrimental effects. The beneficial effects are that it causes various bacterial activities to be increased and that it increases the water soluble plant food in the soil. Its detrimental effects are that it increases soil acidity and that the amounts used have excluded oxygen to a great extent from the soil atmosphere.

Fertilizer experiments with head lettuce show nitrogen to have given better responses than any other element. The principal observed effects of organic manure as compared with chemicals were that it furnished available nitrogen continuously throughout the time of the investigation.

Experiments with winter or dormant pruning have been conducted since the spring of 1912. The main differences in pruning practice employed on the different plats were a rather severe annual heading back as compared with no heading back. The plats receiving no annual pruning also received a minimum thinning out consistent with good orchard practice and no cutting was done except in the case of necessity to preserve the form of the tree. The results for the five-year period, as here summarized, show that neither type of training nor severity of pruning has had a material effect on the average tree growth as evidenced by circumference increase. The growth results attending pruning practices appear to be directly influenced by the moisture conditions immediately following. Of the trees on the plats that have borne fruit, lightly pruned trees have produced on an average 83 per cent more fruit, 35 per cent more highly colored fruit, and 15 per cent smaller fruit than heavily pruned trees during the second year of bearing, corroborating the results of the first year.

Another pruning experiment was started at Bedford, Ind., in the spring of 1916, with the view of studying a number of factors not previously considered.

In this experiment the results of the first season showed that system of soil management exerted a greater effect on tree growth than did pruning. Cutting back the annual growth of these young trees proved to be a detriment in every case, either where the trees were in sod or grown under tillage, and there was no pronounced indication that pruning was less injurious under one system than under the other.

In the cover crop experiment being conducted in the station orchard trees in the plat of early sown rye made the best growth during the past season. Trees on the check plats made the poorest growth records, indicating that it is particularly injurious to leave ground bare. The cover crops maintained a uniform and higher soil temperature than the checks. Observations made in the spring indicate that the green covering tends to deplete the moisture content and lower the soil temperature, while the dead covering tend to conserve the moisture and lower the temperature.

**Vegetable improvement**, H. B. Cowgill (*Porto Rico Dept. Agr. Sta. Rpt. 17*, pp. 27, 28).—A list is given of northern varieties of vegetables that have succeeded at the station, together with a brief preliminary report on tomato feeding experiments.

**The home vegetable garden**, M. F. AHEARN (*Kansas Sta. Circ. 63* (1918), p. 8, figs. 2).—This circular contains concise suggestions for growing a home supply of vegetables, including plans for the rotation of crops.

**Hotbeds for home gardens**, W. E. LOMMEL (*Indiana Sta. Circ. 77* (1918), pp. figs. 7).—This circular discusses the construction, preparation, and management of hotbeds.

**The war garden hotbed**, C. E. DUNST (*Illinois Sta. Circ. 215* (1918), pp. 8, fig. 5).—This circular contains practical directions for the construction and management of hotbeds and cold frames.

**Revised compatibility chart of insecticides and fungicides**, G. P. GRAY (*California Sta. Circ. 195* (1918), pp. 3, fig. 1).—The author's compatibility chart, which was originally prepared in 1914 (E. S. R., 31, p. 751), has been revised to correspond to the best current spraying practice, simplified, and arranged in the form of a circular chart. It indicates the sprays that can be applied in combination, thus reducing the cost of application, and also points out the dangers in apparently harmless combinations.

**Directions for spraying fruit trees in Illinois** (*Illinois Sta. Circ. 212* (1918), p. 12, figs. 3).—This circular is particularly designed to meet the needs of the owners of small orchards. Spray schedules are given for apples, pears, peaches, plums, cherries, currants, gooseberries, and grapes, together with directions for making and mixing the standard sprays.

**The Indiana Horticultural Society's experimental orchard**, J. OSKAMP (*Indiana Sta. Circ. 74* (1917), pp. 16, figs. 7).—The purpose of this circular is to record the work carried on in this orchard by the society and to make the incisions and judgment of J. A. Burton, superintendent, available to the fruit growers of the State. The orchard was started in 1899, largely for variety testing, and was transferred by the society to Purdue University in 1917. The time purpose of the orchard was to produce new and better varieties of apples. In 1900, 10,000 seeds were planted in nursery rows and more seed was planted in 1905. One thousand seedlings of known parentage resulting from cross-pollinations have also been grown. A few of the best of the seedlings that suited in the orchard are here noted and in some cases described.

Summing up the results of the work with seedlings it is concluded that there appears to be no way of forecasting the value of the fruit of an apple tree by the habit of growth of the seedling. Varieties from which seeds have been

planted are Grimes, Stayman Winesap, Rome Beauty, Ben Davis, Salome, Kansas Keeper, Mann, and Kentucky Cider Crab. Seventy-five per cent of the resulting seedlings have been fairly good. Winesap gave the largest number of promising seedlings. Seedlings of Winesap generally preserved the poor root system of the parent and those of Ben Davis the good root system of the parent. From all of the seeds planted in the orchard there has never been a reproduction of the original variety even when fertilized by its own pollen. No specific data are given on the cross-pollinated seedlings.

Studies of the influence of stock on scion have indicated that certain stocks do influence the scion and that others do not. In one case, scions of Yellow Transparent and Chenango were grafted on a wild crab, which had been bearing heavy crops of fruit previous to the insertion of the scions. The stock has not influenced the fruit of either variety, but the ungrafted crab limbs have borne no more fruit and the growth of the stock has been restricted to the limbs bearing the scions. The inserted scions have grown rapidly, whereas there has not been a new growth on the crab limbs of half an inch in the last 13 years.

A comparative test of scions taken from nursery stock and from bearing trees resulted in no observable difference in the bearing qualities of the grafts. The same was true of water sprouts used as scions. Likewise, variations in size and color of fruit of the same variety as observed on different trees were nullified when scions from these trees were grafted on the same tree. From these results as a whole it is concluded that the observed variations within varieties are probably due in almost every case to environment rather than to bud variations and that there is little chance of improving apple varieties through bud selection.

In order to test the effects of spray chemicals on tree roots, enough lead arsenate and copper sulphate to spray a full-grown tree for 30 years was spread on the ground, as far as the limbs reached, around a seven-year old Duchess tree. The only immediate effect was to kill some of the grass and weeds under the tree and the tree was still robust and healthy seven years after this drastic treatment.

As far as the soil in this orchard is concerned fertilizer experiments have given neutral results during a 10-year period. An actual test of a earload of soil imported into the orchard from Wenatchee, Wash., indicates that it is something other than soil that causes early bearing in the Pacific Northwest and that soil is not responsible for variations in quality between far western and eastern apples.

The circular concludes with a report on named varieties of apples planted in the experimental orchard in 1899.

Seed production in apples. C. S. CRANDALL (*Illinois Sta. Bul. 203, ab. (1917)*, pp. 4).—An abstract of Bulletin 203 (E. S. R., 38, p. 245).

Further observations on the effects of pruning, root pruning, ringing, and stripping on the formation of fruit buds on dwarf apple trees, A. W. DRINKARD, JR. (*Virginia Sta. Tech. Bul. 17 (1917)*, pp. 137-146, figs. 5; *Rpts. 1915-16, pp. 137-146, figs. 5*).—This paper gives the results for 1915 and 1916 of experiments started in 1913 to determine the effects of pruning, root pruning, ringing, and stripping at different seasons on the formation of fruit buds on apple trees. A record of the effects which the different operations produced on the fruitfulness of the trees in 1914 is given in a previous paper (E. S. R., 33, p. 735).

The trees received no pruning treatment since 1913, but the results as here presented for 1915 and 1916 continue to show marked effects on fruit.

bud formation due to the original treatments. They confirm in general the conclusions drawn in the previous paper, thus indicating that the influence of a particular treatment or operation may extend over a long period of time. The tabular data obtained for the three seasons, 1914-1916, also show the phenomena of alternate-year bearing. The trees which fruited heavily in 1914 produced relatively few fruit buds in 1915 and heavy crops in 1916. Likewise, light-yielding trees in 1914 bore heavily in 1915 and again lightly in 1916. The various treatments given the trees appeared to shift the fruiting year, since the check trees bloomed on the alternate year as compared with the treated trees. During the period of the experiments the check trees have not produced as many fruit buds as the treated trees.

Studies on methods of protecting ringing wounds on apple trees to promote their healing, A. W. DRINKARD, JR., and A. A. INGHAM (*Virginia Sta. Tech. Bul.* 17 (1917), pp. 147-160, figs. 8; *Rpts.* 1915-16, pp. 147-160, figs. 8).—The object of this study, which was conducted during the years 1915 and 1916, was to secure data on the healing of wounds made by the operation of ringing. An annular cortical section was removed from the trunks of the experimental trees about 12 in. above the ground, the width of the sections ranging from 0.5 to 1.5 in. on different trees. The first series of experiments was conducted by the senior author in August, 1915, some of the wounds being covered with various protective plasters, and others being left exposed. These experiments were performed too late to produce any material increase in the formation of fruit buds on the treated trees, but they showed clearly the possibility of protecting wounds so that healing might proceed properly. Adhesive plaster, friction tape, paraffin paper, cheesecloth inserted in water, and Scott's tree protectors all proved satisfactory. Covering the wounds with paraffin paper was the simplest and cheapest method of protecting them.

During the season of 1916 the junior author performed a series of experiments to determine the conditions which favor the proper healing of ringing wounds without interfering with the object sought through ringing and the practicability of controlling the factors which influence the proper healing of such wounds. The ringing operation included branches of full-dwarf trees varying in circumference from 3 to 5 in., trunks of full-dwarf trees varying from 7.5 to 11 in. in circumference, and trunks of half-dwarf trees ranging from 11 to 15 in. in circumference. The maximum width of ringing wound used on the smaller trees was 1.5 in., and on the larger trees, 3 in.

These experiments showed that the period of fruit bud differentiation should be the controlling factor in selecting the time to do the ringing. For the station locality this time may vary between May 24 and July 26, or possibly between even wider limits, depending upon seasonal conditions. Complete healing was secured with all widths and circumferences used in the experiment and the width of the ring need not be varied to accommodate different tree circumferences. Equally good healing was secured on fairly vigorous trees and on trees appearing very vigorous. However, ringing is more apt to promote fruit bud formation on very vigorous trees.

Moisture is essential for the proper healing of ringing wounds and may be supplied artificially or conserved by checking evaporation. In this work the use of some form of covering, thus preventing evaporation, gave better results than supplying the wounds with moisture artificially.

In no case did paints and similar preparations that were used promote or permit healing. Disinfectants when used alone were of no value, but when used in conjunction with paraffin-paper protectors perfect healing and protection against fungi and bacteria were secured with certain ones, such as a satur-

ated solution of salicylic acid or 10 per cent creolin. One per cent copper sulphate and 2.5 per cent carbolic acid also gave good results.

**Pruning investigations.**—Second report, J. R. MAGNESS, A. F. EDMINSTEIN, and V. R. GARDNER (*Oregon Sta. Bul. 146 (1917)*, pp. 78, figs. 51).—In continuation of previous investigations (E. S. R., 38, p. 237) this bulletin reports the following pruning studies conducted at the station:

*Studies in fruit-bud formation*, by J. R. Magness (pp. 3-27).—In previous work reported by the author it was found that early summer pruning tended greatly to reduce the number of fruit buds formed on the one-year wood. The influence of the pruning was very much localized and only the buds in close proximity to the pruning cut were affected in any way. The studies here reported were conducted largely to determine whether reduction of leaf area through summer pruning is the principal cause of the influence exerted by pruning, to what extent fruit-bud formation is dependent upon leaf area, and to what extent the leaves in any one portion of the tree influence that portion of the tree and other portions of the tree. The trees used in this work were six years old, dwarfed on Paradise stock. The following types of defoliation were practiced: Bulk defoliation, or removing all the leaves from large portions of the trees; defoliation as pruned, or removing the leaves from the same position and to the same extent that summer pruning would remove them; removing all the leaves from certain of the current season's shoots; individual spur defoliation; and the removal of leaves from individual axillary buds. A microscopic study of buds under different defoliation treatments was made.

The defoliation studies as a whole are summarized as follows:

"Fruit-bud initiation will not take place, and fruit buds will not form in most varieties in the absence of a fair amount of leaf area in the tree. Leaf area in one part of the tree will usually not supply food material to the buds in another part to the extent necessary to cause them to become fruit buds. Defoliation one-half of a tree has little influence upon the undefoliated portion, but that part which is defoliated functions as it would if all the leaves had been removed from the whole tree.

"Food material stored in the tree through the dormant season is apparently stored largely in the tissue adjacent to the leaves in which it was manufactured. This is shown by the fact that the defoliated portion of a tree does not develop as strongly and well during the spring following the treatment, as does the undefoliated portion.

"Removing the same number of leaves, without any pruning, has practically the same effect upon the fruit-bud formation for the immediate year following that a summer pruning, removing leaves from the same position, would have. Buds on one-year wood, in areas from which the leaves have been removed are slower in starting out in growth, and make a weaker growth the following spring than do other buds on the same shoots not defoliated. This is more noticeable in some varieties than in others.

"One shoot seems to be very largely independent of other shoots about it so far as fruit-bud formation is concerned. It is apparently largely dependent upon its own leaves for nourishment. Removing leaves from individual spurs tends to prevent the formation of fruit buds upon those spurs, although it does not entirely check the development of flower parts. On those spurs which form fruit buds, notwithstanding defoliation, the blossoms are, on the average, considerably later in opening in the spring.

"Axillary buds of the Wagener seem to be almost entirely dependent upon the immediate subtending leaf for the carbohydrate supply with which they are nourished. Removing the subtending leaf entirely prevents fruit-bud for-

mation. Buds so treated either remained entirely dormant during the following growing season or pushed out into very weak growth. Very few of them showed a development approaching normal.

"Microscopic examinations of buds, both defoliated and undefoliated, taken at intervals during the summer, show little influence of the defoliation so far as development is concerned. No buds were studied that were taken later than September 12.

"There is a very decided decrease in the number of calcium oxalate crystals deposited in the tissues of defoliated as compared to undefoliated buds. This may be indicative of a small supply of soluble carbohydrates and general slow metabolism in the bud tissue.

"Injury to the bark on the trunk of the tree very greatly stimulated fruit-ud formation. This injury brings about very different conditions of nutrition in the tree from those produced by defoliation, for by preventing the normal flow of elaborated foods to the roots, the supply in the top of the tree is greatly increased by the injury of the bark."

*The relation between angle, length, and diameter of shoots and the development of side shoots and fruit spurs from lateral buds, by A. F. Edminster (pp. 28-48).*—The object of this investigation, which was limited to a study of apple shoots, was to obtain a body of evidence upon the amount and type of growth produced by shoots and branches growing at different angles with the view of determining the relation between angle of limb and productiveness. The results are presented in a series of tables and charts and discussed. A brief bibliography of cited literature is given.

As a result of a statistical study of some 9,000 apple shoots the author concludes "that while there is a correlation between angle of shoot and the percentage of lateral buds breaking, on the average this percentage is higher in the case of the more upright than in the case of the more horizontal or drooping shoots. Not only is the total percentage of lateral buds breaking higher, but also the percentage of lateral buds that form fruit spurs. In case of the more spreading varieties, it is the shoots that are more nearly the mean shoot angle for the variety that show the highest percentage of buds breaking.

"There is a comparatively high degree of correlation between the length of shoots and the percentage of lateral buds breaking and of those forming fruit spurs, the longer shoots being the more productive of both side shoots and spurs. A certain relationship also exists between the diameter of shoots and the percentage of their lateral buds breaking and of those forming fruit spurs. The stouter shoots are the more productive of both side shoots and spurs.

"On the average, the more upright shoots are also the longer and the thicker. In other words, there is a positive correlation between the three factors—angle, length, diameter. That each factor is more or less independent of the others, however, in its influence upon the breaking of lateral buds is indicated by the fact that, on the average, shoots of the same length and diameter still show the influence of angle, those of the same angle and diameter still show the influence of length, and those of the same angle and length still show the influence of diameter.

"When in pruning, a choice is presented, it would seem the part of wisdom to preserve those shoots that are long, stout, and more or less upright, or that at least approach the mean shoot angle for the variety."

*The influence of bending dormant shoots upon their subsequent behavior, by V. R. Gardner (pp. 49-56).*—The object of the present investigation was to ascertain what are the actual results of bending one-year old apple shoots.

Prior to the bending experiments detailed records were made of the characteristics of 1,658 apple shoots (Grimes and Esopus) at the end of the growing season. Seven hundred and eighty-three of these shoots were then artificially bent while still dormant and fastened in new positions. Records were then made at the close of the following growing season as to increase in diameter, amount of new shoot growth, and number of fruit spurs formed. The results of the study are summarized as follows:

"The data show that on the average the total percentage of buds 'breaking' on the artificially bent shoots was practically the same as that on check shoots. Artificial bending did not materially influence the percentage of buds that formed fruit spurs or the percentage that formed new shoots; though in one of the two varieties studied it proved a stimulus to shoot growth rather than a check. The artificial bending resulted in a change in the location or distribution of fruit spurs and of new shoots on the shoots of the preceding season. Its general tendency was to increase the number of fruit spurs toward the terminal end of the shoot and decrease them toward the basal end. Conversely, its general tendency was to decrease the new shoot growth from the terminal portion of the shoot and increase it from its basal portion.

*The winter heading back and thinning out of apple shoots in young trees*, by V. R. Gardner (pp. 57-78).—This article presents tabular data dealing with the effect of winter heading back of one-year-old shoots upon the subsequent development of spurs and branch shoots from those same shoots; the effect of winter thinning out upon the development of new spurs on adjacent unheaded shoots; the effects of winter heading back and of thinning out upon fruit-bud formation on previously established spurs; and the effects of these two methods of pruning upon the formation of terminal and lateral fruit buds on the new shoots of the following season.

The author's conclusions based on these data are summarized as follows: "A statistical study of 1,053 individual Grimes shoots in young trees upon winter heading back warrants the following statements:

"In general, heading the individual dormant apple shoot decreased the number of new branch shoots to which it gave rise, this decrease in number of new shoots being greater with increase in severity of heading.

"In this variety, heading back, within the range employed (i. e., 0-80 per cent) exerted comparatively little influence upon the amount of new shoot growth to which the individual shoot gave rise. In other words, the amount of new shoot growth to which a shoot will give rise the following year is correlated with the length before pruning rather than with its length after pruning or with the amount or severity of the pruning it may receive. There is reason to believe that in some varieties it acts as a stimulus to shoot growth.

"Heading back resulted in a decrease in number of fruit spurs to which the individual shoot gave rise, the decrease being more marked with increase in the severity of heading. In other words, fruit-spur formation on the individual shoot is correlated with the length of the shoot after, rather than before, pruning.

"Though the new shoot growth produced by headed shoots tended to be closely correlated with the size of the original shoot, rather than with what is left of the shoot after heading, the data show that comparatively severe heading tended to subordinate its relative position in the tree. The effects of continued severe heading are cumulative, and consequently it is comparatively easy to check or make more important one part of the tree that is growing too rapidly or too slowly.

"A statistical study of the comparative effects of winter heading back and of thinning out in 461 young apple trees, including trees of Grimes, Gano, Rome, and Esopus, warrants the following statements:

"Broadly speaking, a general heading-back of the shoots of a tree acted as a stimulus to new shoot growth, resulting in an increase in number of units of new shoot growth for each unit of old, as compared with unpruned trees. The amount of this stimulus varied considerably with variety. On the other hand, an equally severe thinning acted as a check to new shoot growth, resulting in a decrease in number of units of new shoot growth for each unit of old, as compared with unpruned trees. The amount of this check varied considerably with variety.

"Lessened fruit-spur formation accompanied winter shoot pruning of any kind—either thinning out or heading back. In the case of profuse spur-bearing varieties, like Esopus and Grimes, heading-back resulted in a much more marked check to fruit-spur formation than equally severe thinning out. This was not so true with those varieties like Gano and Rome that when young bear a larger percentage of their fruit buds laterally upon shoots.

"The comparative effects of thinning out and of heading back upon fruit-bud formation varied considerably with the variety. In general, it was found that thinning led to an increased production of fruit buds upon spurs, as compared with equally severe heading. On the other hand, heading generally led to an increased production of fruit buds terminally upon shoots. In some varieties, thinning was accompanied by a greater production of lateral fruit buds on shoots than equally severe heading; in other varieties the reverse was the case. Considering the comparative effects of thinning out and of heading back, not only upon fruit-bud formation, but upon fruit-bud removal as well, it is evident that the continuation of the former practice tends to increase flower and fruit production, while the latter tends to decrease those functions.

"There was little difference between the effects upon increase in trunk circumference of winter heading back and winter thinning out."

**Orchard heating.** F. L. West and N. E. EOLEFSEN (*Utah Sta. Bul. 161 (1917)*, pp. 3-48, figs. 2).—This bulletin reports the results of orchard heating experiments conducted at the station, cites some of the results secured by other investigators, discusses the conditions under which artificial heating would be financially profitable, and describes the most approved method of carrying out the work. A list of cited literature is appended.

Among the experiments conducted by the authors, water at a temperature of 55° F. was piped under 50 lbs. pressure to the top of each of the trees in an acre of apricots. The water left the pipes as a fine spray to a distance just sufficient to cover very thoroughly the entire tree. With the spray on two nights, the treated section was found to be 0.5° colder than the air outside and as the same both nights. The spray was left on until noon each day. Although the air was warming up the mean temperature underneath the cloud was one morning 1.1° colder than the adjoining section and the other morning 1.5° colder; showing that the cloud of spray slightly retarded the warming effect of the sun. When the spray was applied on a night when frost occurred, the sediment in the water clogged the fine spray, and the coarse spray, even though the water was warm before leaving the pipes, collected in the fruit buds and froze them; producing the same effect as a storm of sleet.

An experiment was conducted at the station in the spring of 1910 under the direction of W. H. Homer, Jr., in which carbon dioxide was employed as a "mudge without the addition of heat. Ninety-six lbs. of carbon dioxide was

liberated in one acre of an orchard during the night in a period of  $2\frac{1}{2}$  hours. The gas not only failed to keep the treated area warmer than the adjoining section but actually cooled it slightly.

In later experiments conducted by the authors the relative merits of heat and smudge were tested under controlled conditions; the heat being supplied by means of electric heaters, the construction of which is here briefly described. Electric heaters were placed in the bottom of an approximately airtight box, 2.5 by 4.5 ft. and  $7\frac{1}{2}$  ft. deep, and they gave a rise in temperature of  $14.1^{\circ}$ . With 22 lbs. of carbon dioxid (three times the volume of the box) which had been warmed to the same temperature as the box before it entered, the heaters gave a rise of only  $2.8^{\circ}$  more than with no smudge, the gas being liberated in 50 minutes. A test of the air inside of the box showed 3 per cent carbon dioxid there. This result was duplicated on a larger scale by heating (with electric heaters) an area of 500 sq. ft. surrounded by walls, thus indicating that a smudge of carbon dioxid is practically of no value in confining heat arising from orchard heaters.

In order to determine the amount of heat required to warm air, electric heaters were distributed about in the open in the same manner as smudge pots are distributed in the orchard. The heaters were not placed in an orchard because electric power was not available there. As a result of six experiments 100 horsepower of electrical energy when converted into heat in the open air gave a temperature rise of  $20^{\circ}$ , the temperature outside being  $70^{\circ}$ . It required approximately 14 watts per square foot to obtain  $1^{\circ}$  rise in temperature. The results of 15 investigations of other stations show that with 100 heaters to an acre the orchard will remain about  $4^{\circ}$  warmer than the surrounding unheated area. Winds of 10 miles an hour reduce this to less than  $1.5^{\circ}$ . Assuming that the common smudge oils give out 18,800 B. t. u. of heat per pound burned and that a gallon of this oil lasts 4 hours, the authors figure that these smudge pots develop approximately 6 watts per square foot in raising the temperature of the air in the orchard  $1^{\circ}$ .

The authors' investigations on hardness of fruit buds to frost (E. S. R., 37, p. 344), some data on which are here given, indicate that fruit buds are less sensitive to cold than is commonly believed; hence there is a tendency to start orchard heaters too soon and too often. The equipment necessary, and the best method of orchard heating, the forecasting of frost, and the cooperation of the Weather Bureau, are given with considerable detail. The average dates of the blooming period of apples and peaches in the five leading horticultural counties of Utah are given, together with data showing the number of nights each year that heating would have been necessary in the past 16 years.

A careful study of the data on fruit yields, selling price, and frost damage shows that by the most economical heating the value of the fruit saved is approximately equal to the cost of saving it. Mathematical equations are worked out, graphed, and explained, showing under what conditions artificial heating would be financially profitable. Summing up this discussion the authors conclude that "to increase one's profits or decrease his losses by heating, the sale price of the fruit must be high, the fuel must be cheap, the frost must not be accompanied by winds, and the heating must be carried out according to the most modern methods with military precision. It is very doubtful whether it pays in Utah."

Intercropping of young irrigated orchards, R. S. VAILE (*California Sta. Circ. 194 (1918)*, pp. 11).—This circular presents the results of a survey conducted during 1917 to determine the extent to which young orchards were being utilized for growing secondary crops.

The data secured indicate that at least 45 per cent of the young orchards were intercropped in 1917 as compared with only about 25 per cent under normal conditions. Some data are given showing the financial returns secured in some of these orchards, together with the results from intercropping 60 acres of citrus orchard at the Citrus Experiment Station with black-eye beans in 1917. Under the existing high prices the black-eye beans yielded a net profit of \$30.46 per orchard acre (0.75 acre) or \$40.64 per full acre. Suggestions are given relative to the selection and management of intercrops in young orchards.

Report of the cranberry substation for 1916, H. J. FRANKLIN (*Massachusetts Sta. Bul. 180 (1917)*, pp. 183-234).—The substation work during 1916 was mainly along the lines reported for 1915 (E. S. R., 36, p. 43).

Some work in blueberry culture was started with the view of determining the feasibility of utilizing bogs unsuited to cranberry culture. A number of selected and bred strains provided by the U. S. Department of Agriculture, together with selected wild plants, are to be tested.

Weather observations were made as in previous years. A prolonged wet season caused a large proportion of the blossoms to fail to set fruit and small fruit was seriously damaged by flooding. In the author's opinion the late holding of winter flowage throws the blossoming period out of its normal season and enhances the danger of its meeting unfavorable conditions for the setting of fruit.

Further experiments with shade tobacco cloth as a means of frost protection indicate that two thicknesses of the cloth spread on the vines will probably afford most of the Cape bogs sufficient protection. However, this method of protection is expensive and is not satisfactory on bogs with much moss under the vines, because of the reduced radiation on such bogs. Water is a better medium of protection if it can be applied at reasonable expense. The results of these investigations show that for bogs in warm or average locations that are flooded by pumping it is unprofitable in the long run to try to protect well-colored berries from frost, especially if the crop is light. Ripened Early Black or Howes cranberries are not injured from exposure to 23° F. and sample lots submitted to a temperature of 9° only showed about 50 per cent frosted fruit. No temperatures low enough to harm well-colored berries occurred at the station bog in any pickling season from 1911 to 1916, inclusive.

Storage tests to determine factors influencing the keeping quality of cranberries were continued. The results are presented in tabular form. They indicate that cranberries should not be picked wet. Scoop picking is not particularly harmful to keeping quality, but deep scoop picking causes a maximum amount of under berries, loose leaves, and sand to be gathered, these materials being harmful in storage. Cranberries exposed to the sun on the bog for several hours after picking seemed to keep about as well as those housed at once under average storage-house conditions. It is suggested, however, that berries exposed to the sun might not keep as well as berries quickly cooled after picking and placed under cold-storage conditions. Lack of sufficient ventilation affects cranberry keeping adversely, apparently by interfering with the processes of respiration, thus permitting the accumulation of carbon dioxide gas given off by their tissues and at the same time reducing their supply of oxygen. Relative to storage previous to shipment it is concluded that low temperatures, because of their retarding effect on the processes of respiration and on the growth of rot-producing fungi, seem most important. The berries should be carefully graded and banded in packing and the containers should be small and well ventilated.

The year's experience with resanding plats is presented in tabular form and compared with previous results. The yield and relative keeping quality of berries grown on different fertilizer plats in 1916 are also given.

The fruit of the fertilized areas was as a rule much inferior in both quantity and keeping quality to that of the checks, this being especially marked with the plats treated with lime and with the maximum amount of nitrate of soda. Summing up the results of the fertilizer work since it was started in 1911 the author concludes that in general whatever slight advantage in yield has been gained by the use of the fertilizers has been balanced by the cost of the treatment, the deterioration in the quality of the fruit, and the greater cost of picking due to the increased vine growth.

The season's work with plant diseases and insects is noted on pages 55 and 60.

Sterility in the strawberry, W. D. VALLEAU (*Jour. Agr. Research* [U. S.], 12 (1918), No. 10, pp. 613-670, pls. 6, figs. 4).—This paper reports studies on the sex condition in strawberries (*Fragaria* spp.), which have been carried on at the Minnesota Experiment Station during the past four years. The primary object of the investigation was to determine some satisfactory explanation for the phenomenon of pollen abortion which is so prevalent among heterozygous plants or plants of hybrid origin. The study of pistil sterility and anther abortion in the cultivated varieties and wild species, which are the result of a strong tendency of this genus toward dioeciousness, also received considerable attention. The results of the studies are presented in a series of tables, illustrated by a number of plates, and fully discussed. A bibliography of cited literature is given.

Summing up the investigations as a whole the author arrived at the following conclusions: "The flowers of *Fragaria* are pentamerous with regard to all parts except pistils. The stamens are arranged in three whorls; the outer parapetalous series of 10 stamens, the middle antipetalous, short filamented series of five, and the inner antisepalous series of five. Increases in stamen number are due to the addition of five, or a multiple of it, to either the antipetalous or the antisepalous series. Decreases in stamen number are due to the loss of first the antipetalous and next the antisepalous series. Apparently the parapetalous series is permanent. Decrease in stamen number is in no way related to dioeciousness. There is a positive correlation between flower position, flower part number, and size of fruit in the strawberry.

"The wild American species of strawberry, from which the cultivated varieties have been derived, are for the most part dioecious. The pistillate plants bear staminodia, which rarely develop as far as the pollen mother cell stage, and the staminate plants bear pistils which superficially appear to be perfect but which are only occasionally functional. In a few wild clones of *F. virginiana*, which appear to be sterile, pollen development is carried as far as the tetrad division or slightly beyond this to the liberation of the microspores, when complete disintegration of the anther contents to an oily mass takes place. In other instances a portion of the microspores develop normally while the remainder within the same anther disintegrate, while in other clones shortly after liberation, and following a slight growth of the microspores, complete abortion of the same type as that found in hybrids takes place. These anther types, in wild clones, all appear to be various expressions of a tendency toward dioeciousness and are not the result of hybridization. Similar anther types are common in certain cultivated varieties, on the early flowers of an inflorescence, and especially on those appearing early in the season.

"There is a correlation between flower position and fertility of pistils, fertility decreasing in the later flowers of an inflorescence. Pistil sterility is expressed in the production of irregularly shaped berries or entirely sterile flowers.

Sterility of the later flowers of an inflorescence is more general in hermaphrodites than in pistillates, suggesting that the hermaphrodites have been derived from staminates of the diceous wild forms.

"The appearance of considerable amounts of aborted pollen in wild plants of *F. virginiana* and *F. americana* is rare except in authors of the intermediate type. Most cultivated varieties produce considerable amounts of aborted pollen of the type common in hybrids. The percentage of aborted grains is not constant in the individual flowers of a variety and neither is it constant in the individual anthers of a single flower, as just as great variations appear within the anthers of a flower as are shown by composite pollen samples of individual flowers.

"In those varieties producing high percentages of aborted grains a portion, at least, of the morphologically normal pollen grains are functional as shown by germination and bagging tests. There is no evidence of physiological self-sterility in the strawberry. In the partially sterile variety Minnesota 3 pollen development is carried on normally up to the liberation of the microspores from the tetrad. At this time all of the microspores appear normal and alike. Following liberation, variations in rate of growth, time of division of the microspore nucleus, and ability of the individual microspores to develop normally are shown. At all stages during the growth period microspores were found in various stages of abortion. *F. virginiana* exhibits as great regularity during this growth period as is shown in the stages leading up to liberation of the microspores.

"Liberation of the microspores from the tetrad marks the beginning of an independent gametophytic generation, so far as the metabolic processes of growth are concerned. The individual microspores float in a homogeneous nourishing medium provided by the sporophyte, but the use of this food material in cell metabolism depends entirely upon the individual organization of the microspores.

"Specific chromosome combinations have been shown by various investigators to be a potent factor in the development or lack of development of individual plants or animals. In plants heterozygous for a number of factors, as are the varieties of strawberries, numerous new chromosome combinations occur for the first time in the microspores. The varying rates of growth, time of microspore division, ability to increase the cytoplasm, and inability in many cases to develop normally seem to be the outward expression of the differential ability of these new chromosome combinations to carry on cell metabolism."

Growing and marketing of grapes, R. T. REED (*Washington Sta., West. Wash. Sta. Mo. Bul.*, 5 (1918), No. 12, pp. 174-177).—Popular Instructions for growing and marketing grapes, based largely on the author's experience in a grape vineyard in western Washington.

Report of the chemist (*Porto Rico Dept. Agr. Sta. Rpt. 1917*, pp. 123-131).—This consists mainly of a progress report on an experiment undertaken with grapefruit to determine the relation of the various factors of soil, fertilizer, etc., to the process of ripening. Analyses of fruit from selected trees and picked at different dates are here recorded, together with analyses of soil from some of the test groves. No conclusions have been drawn from the data thus far secured.

Determinations of the ratio between the soluble solids and the acid content of citrus fruits have shown that there is practically no difference in the ratio of solids and acids between fruit held in the laboratory and those sweated. There was apparently a slight increase in the ratio in fruits held from one to three weeks. Much of the fruit from early bloom gave a satisfactory ratio by the middle of October.

## FORESTRY.

**Manual of forestry for the northeastern United States, R. C. HAWLEY and A. F. HAWES** (*New York: John Wiley & Sons, Inc., 1918, pp. XII+281, figs. 65*).—This is a revision of part 1 of *Forestry in New England*, which formerly appeared as one volume (E. S. R., 27, p. 646). Volume 2 of the revised edition will be entitled *New England Forests and Their Management*. Although written with special reference to New England the authors state that the book is directly applicable to northeastern United States and southeastern Canada.

**Report of the Maryland State Board of Forestry for 1916 and 1917, F. W. BESLEY ET AL.** (*Rpt. Md. Bd. Forestry, 1916-17, pp. 86, pls. 8*).—A report on various activities during 1916 and 1917, including assistance to owners of woodlands, forest fire protection, war work, educational and investigational work, operations on the State forest reserves and nursery, recommendations for 1919 and 1920, and a financial statement. Appended to the report is information relative to the Maryland Forestry Association, protection and use of State lands, trees available for planting at the State nursery, the white-pine blister disease, and forest fires in 1916 and 1917.

**Annual report of the department of forestry for the year ended June 30, 1916, R. DALRYMPLE HAY** (*Rpt. Forestry Dept. N. S. Wales, 1916, pp. 17, pls. 4*).—This is the usual progress report (E. S. R., 34, p. 838).

**Report of the forestry commission for the year ended June 30, 1917, R. DALRYMPLE HAY ET AL.** (*Rpt. Forestry Com. N. S. Wales, 1917, pp. 20*).—This report first outlines the policy of the forestry commission created under legislation in 1916, and cites the steps taken during the period of this report toward the inauguration of the new administration in conformity with the forest policy. Information is then given on the administration of the forests, forest areas, State forest organization, forest fires, silviculture, revenues and expenditures, imports and exports of timber, etc.

**The need of a transformation in our afforestation methods in the mountains, F. FANKHAUSER** (*Schweiz. Ztschr. Forstw., 69 (1918), Nos. 1, pp. 1-7, pl. 1; 2, pp. 25-34, pl. 1, figs. 4*).—A discussion of various factors involved in the afforestation of mountain regions in Switzerland, including suggestions for improving methods now employed.

**Concerning site, C. G. BATES** (*Jour. Forestry, 16 (1918), No. 4, pp. 383-388*).—The author is of the opinion that the Forest Service of the U. S. Department of Agriculture and other agencies now possess abundant data on the growth and increment of all the more important American species of trees, so that the range of productiveness of each species could quite certainly be determined and uniform standards of site quality could be fixed. A standard plan for classifying sites by quality of production is here presented and discussed.

**Notes on North American trees.—I, Quercus, C. S. SARGENT** (*Bot. Gaz., 65 (1918), No. 5, pp. 423-459*).—This is the first of a series of contributions comprising notes on the distribution and characteristics of North American trees. Some 28 species and 34 varieties of oaks are considered in the present article.

**Distinguishing characters of North American sycamore woods, W. D. BUSH** (*Bot. Gaz., 64 (1917), No. 6, pp. 480-496, pls. 7, figs. 3*).—A study of native North American sycamores with reference to the gross and minute structure of the woods and individual characteristics of the species.

**Aspen reproduction in relation to management, F. S. BAKER** (*Jour. Forestry, 16 (1918), No. 4, pp. 389-398*).—This paper presents results secured in studies of aspen reproduction by seed and vegetative reproduction as conducted at the Utah Forest Experiment Station, Ephraim, Utah. These studies show that reproduction by root suckers is practically the only means by which

aspen stands are regenerated in that region; hence the management of these stands is simple and reproduction certain, with adequate protection from sheep grazing.

**Agency of fire in propagation of longleaf pines,** E. F. ANDREWS (*Bot Gaz.*, 47 (1917), No. 6, pp. 479-508, figs. 5).—A discussion of this subject based on observations of natural reproduction following fire in Floyd County, Ga.

**The effect of planting method upon growth of western yellow pine,** H. C. TURNER (*Jour. Forestry*, 16 (1918), No. 4, pp. 399-403).—The author presents some data based on planting experiments conducted at the Fort Bayard nursery, New Mexico, to show that any distortion that is imparted to the roots at the time of planting is retained for an indefinite period and that this distortion affects adversely the tree's future growth. Spreading the roots of the tree seedlings over the surface of a cone of earth in the center of the planting hole has given the best results from the standpoint of root development and height growth, but probably does not warrant the additional expense involved over the method of planting in the center of holes wide enough to permit the roots to be spread out fairly well in different directions.

**Correlation of the strength and durability of southern pine,** S. M. ZELLER (*Ann. Missouri Bot. Gard.*, 5 (1918), No. 2, pp. 109-118, pls. 5).—In a recent paper the author reported results of experiments in which some important physical properties of southern pine woods were correlated with the decay induced by *Lezsites sepiaria* (E. S. R., 37, p. 727). This paper gives the results of studies made on the resistance to decay of timbers which had actually been tested for strength.

Briefly summarized the author concludes that "whether we are dealing with shortleaf pine or longleaf pine the stronger pieces of heartwood are the more durable, and vice versa. This, however, does not apply to sapwood, as it seems to decay irrespective of the amount of summer wood and specific gravity, which materially influence the strength of yellow-pine sapwood."

**Tapping experiment at New Lunderston Estate,** F. G. SPRING and B. BUNTING (*Agr. Bul. Fed. Malay States*, 6 (1918), No. 4, pp. 188-194).—This experiment which was conducted at Banting, Federated Malay States, was arranged to show the respective yields from tapping rubber trees on one-quarter, one-third, and one-half the circumference. The trees were tapped daily by a single oblique cut to the left at a height of 14 in. from the ground. The results for the period, 19.5 months, indicate a considerable advantage in favor of tapping on one-half the circumference, both as to yield and cost of tapping.

**A bibliography of recent literature dealing with plantation rubber,** A. A. L. RUTGERS (*Arch. Rubbercult. Nederland. Indië*, 1 (1917), No. 6, pp. VI+55-57).—The literature is classified by subjects and also by authors, and a brief résumé is given of the contents of each article. The principal subject headings are cultivation, preparation, diseases and pests, rubber in different countries, addresses, reports, miscellaneous, and periodicals.

#### DISEASES OF PLANTS.

**Report of the botanical department,** H. S. JACKSON (*Indiana Sta. Rpt. 1917*, p. 22-24).—A brief report is given of the activities of the botanist and members of the botanical staff, the investigations including studies of rusts, wheat diseases, tomato diseases, and cucumber diseases.

The work with tomato diseases has been largely done by G. A. Osner, associate botanist, and particular attention was given to the streak blight of tomatoes. This disease is said to be characterized by the appearance of black

streaks on the stems and petioles and dark sunken spots on the leaves. Repeated attempts to isolate an organism from diseased tissues have yielded negative results in every case. Infection is readily secured by inoculation either with or without injury, using extracted juices from diseased plants. Attempts to transmit the disease through pollen from diseased plants have given negative results. It is believed that the causal agent may overwinter in the old stems and gain entrance to the young plants through the roots.

The associate botanist continued his study of the new leaf spot of cucumber previously noted (E. S. R., 37, p. 840). The organism causing this leaf spot has been noted as an undescribed species of *Stemphylium*.

In cooperation with the U. S. Department of Agriculture, a plant disease survey is being conducted, some of the more important new diseases observed in the State being *Illosporium* leaf spot of apple; bacteriosis of beans; *Cercospora* and *Macrosporium* leaf spots of carrot; *Amerosporium* leaf spot of cowpea; *Cercospora* leaf spot of cucumber, muskmelon, and squash; white rust of salsify; and ergot of timothy and orchard grass.

Minor diseases and notes, J. A. STEVENSON (*Porto Rico Dept. Agr. Sta. Rpt.* 1917, pp. 88-98).—Minor diseases of plants are reported, and a leaf spot of the corozo palm due to *Cercospora acrocomiae* n. sp. and a pink scale fungus (*Tuberularia coccicola* n. sp.) are described.

Plant diseases in Virginia in 1915 and 1916, F. D. FROMME (*Virginia Sta. Rpt. 1915-16*, pp. 187-192, figs. 5).—This report includes information regarding attacks of stem crack (*Rhizoctonia solani*) at the soil line of bean plants; downy mildew (*Phytophthora phascolii*) on lima beans; root knot (nematodes) on beet, parsnip, and salsify; blackleg (*Phoma oleracea*) of cabbage; sclerotium wilt (*Sclerotinia trifoliorum*) on crimson clover; anthracnose (*Glomerella gossypii*) on cotton; wilt (*Fusarium vasinfectum*) on cowpea; Pestalozzia rot (*P. uricola*) of grape; wilt (*Fusarium* sp.) on peanut; and wilt (*F. lycopersici*) on tomato.

Lessons from the rust epidemic of 1916, J. BRACKEN (*Saskatchewan Dept. Agr. Bul. 50* (1917), pp. 16, figs. 54).—This bulletin indicates the practices that were found to result in the most satisfactory yields in the investigation field at Saskatoon during 1916, when rust proved to be a factor causing serious loss. These practices include employment of early varieties or early seeding, a medium type of loam soil, cultural treatments promoting early maturity, a medium to thick stand, use of rust resistant varieties, and destruction of alternate hosts of the fungi which cause cereal rusts.

Vegetable diseases, J. A. STEVENSON and R. C. ROSE (*Porto Rico Dept. Agr. Sta. Rpt. 1917*, pp. 83-88).—Notes are given on a number of the more common diseases observed to attack vegetables in Porto Rico, with suggestions for their control, so far as definite means are known.

Some common diseases of vegetables, J. B. DEMAREE (*Ann. Rpt. State Ent. Ind.*, 9 (1915-16), pp. 77-90, figs. 9).—This deals very briefly with diseases and remedies therefor as relating to asparagus, bean, beet, cabbage, celery, cucumber, eggplant, lettuce, melon, onion, pea, potato, sweet potato, and tomato.

Diseases of beans, W. G. SACKETT (*Colorado Sta. Bul. 234* (1918), pp. 23-32, figs. 6).—This is part of a revision of Bulletin 226 (E. S. R., 37, p. 248).

Orobanche on bean, S. JOVINO (*Staz. Sper. Agr. Ital.*, 49 (1916), No. 9-10, pp. 514-529).—It is stated that Orobanche is one of the chief local causes of loss in connection with the production of beans. This is due largely to the number of varieties attacked by it and to the smallness and number of its seeds. An account of experimentation with *Helminthia* (*Picris*) *echioides* concludes with the statement that the germination of the seeds of Orobanche, which ordinarily requires a long previous rest and then proceeds slowly, may be hastened in the

neighborhood of *Helminthia*, so that this may be employed as a sort of trap plant for the control of *Orobanche*.

A study of *Rhizoctonia violacea*, H. A. A. VAN DER LEK (*Meded. Rijks Toogere Land, Tuin en Boschbouwesch.* [Wageningen], 12 (1917), No. 2, pp. 49-130, pls. 9).—The author gives an account (also his ahridgment thereof in French) regarding studies carried out with *R. violacea* since its appearance on carrots in 1915 near Wageningen.

Rust of castor bean, G. ARNAUD (*Bul. Soc. Path. Veg. France*, 4 (1917), No. 1, pp. 37-39).—Leaf rust (*Uredo ricini*) of *Ricinus* is reported to have been observed in 1917 at Rahat, Morocco.

A new disease of lupines, B. PEYRONEL (*Staz. Sper. Agr. Ital.*, 49 (1916), No. 11, pp. 583-596, pls. 5, figs. 5).—A descriptive account is given of a root and stem disease of lupines said to be new, and of an associated fungus which is technically described as a new genus and species, *Chalaropsis thielavioides*.

Potato seed diseases and their treatment, L. E. MELCHERS (*Kansas Sta. Circ.* 63 (1918), pp. 2).—The potato crop of Kansas is said to have suffered losses during 1917 ranging from 1 to 25 per cent on account of blackleg, black scurf (*Rhizoctonia* sp.), dry rot or wilt, and scab. These diseases are briefly discussed as to their control. Corrosive sublimate is preferred to formaldehyde as a preventive treatment for potato tubers in this State.

Potato diseases, D. C. BABCOCK (*Ohio Sta. Bul.* 319 (1917), pp. 121-136, figs. 10).—This bulletin discusses the principal potato diseases in Ohio under three heads according to the means of control, namely, selecting clean seed (dry rot, or Fusarium wilt, blackleg, and leaf roll); treating the seed tubers (scab and Rhizoctonia); and spraying (late blight, early blight, and tipburn).

The "mottling" disease of cane, J. A. STEVENSON (*Porto Rico Dcpt. Agr. Sta. Rpt.* 1917, pp. 40-78).—A detailed account is given of an investigation on a disease of sugar cane, a preliminary account of which has already been noted (E. S. R., 38, p. 150). After a careful study of the trouble, the author has decided to call it the mottling disease of cane from its most conspicuous character.

The symptoms of the disease are said to be mottling of the leaves with no other observable change in the canes at first, followed, generally in the first or second ratoons, by a dwarfing of the plant, the presence of cankers or lesions on the stalks, and a decrease in the amount of juice. While no variety has been found resistant, yet there is considerable variation in the amount of disease present in the different varieties, and this is thought to offer some hope of combating the trouble. Thus far, no definite cause has been found for the disease, although from field experiments it seems to be readily transmitted.

In the previous report, recommendations were made for the control of the disease, but subsequent investigations have shown that none of the measures so far tested is successful. The author recommends that where fields have become badly infected they should not be replanted to cane for at least a year, preferably longer, but should be used for pasture or for other crops. Diseased seed cane, as well as seed material from badly infected fields, should be avoided, and where the disease has not gained great headway, every effort should be made to produce a healthy crop by plowing, fertilization, cultivation, etc.

Brief notes are given on some minor diseases of sugar cane, particularly a brown rot due to *Diplodia cacaocola*.

Studies of the etiology and control of blister canker on apple trees, J. R. COOPER (*Nebraska Sta. Research Bul.* 12 (1917), pp. 117, figs. 25).—The author gives an account of a study on blister canker of apple (*Nummularia discreta*). This disease, since its recognition as a destructive parasite of apple reported by Hasselbring (E. S. R., 14, p. 160), has become the most serious disease of apple

trees in the United States, the fungus occurring in all of the fruit-growing regions east of the Rocky Mountains and practically every orchard in the State of Nebraska being more or less infected.

The symptoms vary, being affected by variety, age of trees, available water and soil nutrients, and general weather conditions. They may resemble those accompanying sun scald, winter injury, collar rot, and the so-called arsenical poisoning. The organism is a wound parasite attacking either roots or branches, and it may be present for several seasons before becoming visible externally. It is disseminated by means of infected wood, conidia, or ascospores, both of these reproductive bodies being produced throughout the growing season under favorable weather conditions. Conidia usually appear during the season in which the canker first appears, ascospores one or more seasons later, and both may be borne on the same stromata for many seasons thereafter. Ascospores are much more viable than are conidia, but the latter are also important agents in the spread of the disease.

Infection occurs rarely in case of rapidly growing tissues, but readily in case of inactive xylem tissues. The cellular structure is not destroyed, as the fungus penetrates by way of the pits in the cell walls, making more rapid progress longitudinally through the trachea than transversely, though the medullary rays facilitate the advance in a radial direction. The characteristic brown discoloration is always associated with the presence of the hyphae, though sometimes extending some distance beyond their advance. The fungus usually grows faster below than above the point of entrance, if that be aboveground. If inoculated below the surface of the ground, the reverse is true. Susceptibility depends largely upon variety, the vigor of the tree, the available supply of water and of nutrient solutes, and the season in which inoculation occurs, being less in early spring and summer during rapid growth. Fertilizing experiments have shown little or no benefit. Variation in resistance may be due to chemical as well as to anatomical and physiological factors.

It is thought that control must depend upon prevention, as cures of trees once affected are possible in very few cases. Heavy pruning aggravates the disease. Either copper sulphate or lime sulphur applied to the cankers is effective. All wounds should be covered. Liquid asphaltum appears to be about as effective as white lead and oil for this purpose. The first coat should be thin, the second heavier.

Methods of controlling blister canker, J. R. COOPER (*Nebraska Sta. Bul. 161 (1917), pp. 18, figs. 8*).—This is a popular edition of the bulletin noted above.

Apple or cedar rust, R. C. WALTON (*Mo. Bul. Ohio Sta., 3 (1918), No. 3, pp. 86-88, figs. 5*).—It is stated that of the Ohio counties reporting apple rust 91.3 per cent are in the southern half of the State where the red cedar is more abundant as a native tree, though both this tree and the disease exist more or less in all parts of the State. In some apple varieties, as Rome Beauty, infection of the fruit is frequently severe in addition to the leaf infection. Winesap, Stayman Winesap, and Maiden Blush are named as resistant, Ben Davis and Grimes Golden as moderately so. The best method of control is destruction of all cedars within one mile of the orchards.

Dusting for cedar rust, F. D. FROMME and H. E. THOMAS (*Virginia Sta. Rpts. 1915-16, pp. 179-183, figs. 2*).—Having used successfully a dusting mixture containing copper for late blight of tomato (E. S. R., 36, p. 750), the authors tested this plan employing a dust mixture containing sulphur, hydrated lime, and lead arsenate in the ratio of 15:5:4, for cedar rust (*Gymnosporangium juniperi-virginianae*), on apple trees adjacent to cedars. Treatments were applied either before each important rain, after such rains, or on the regular spray schedule.

No constant decrease of infection could be found on any of the plots receiving dust applications.

**Control of cherry leaf spot in Wisconsin.** G. W. KEITT (*Wisconsin Sta. Bul. 286 (1918)*, pp. 11, figs. 8).—This is a report based on work done by the author during two seasons with cherry leaf spot (said to be the most serious fungus disease of cherry in Wisconsin) in the attempt to ascertain the times and numbers of sprayings which would give the best and most economical results under present conditions as regards prices of labor and materials.

The most obvious feature of the disease is the loss of the leaves, resulting in a lowering of vitality and failure of the fruit to attain its normal growth and maturity. The disease also affects the fruit and fruit stems. The causal fungus overwinters in dead leaves on the ground, giving up spores in spring which repeat the infection.

Early and clean cultivation greatly aids control by reducing the number of spores set free.

As a result of comparative tests in 1916 and 1917 it is found that while Bordeaux mixture is safe at a strength of 2:2:50 in case of good sanitation and timely applications, the 1:1:50 strength is not to be recommended for commercial use, but the 3:3:50 formula may be used with full confidence in Wisconsin. Lime-sulphur at a specific gravity of 1.2946 diluted at the rate of 1:40 or 1:30 was also satisfactory, especially when containing lead arsenate (1 to 1 lb. in 50 gal. water, or if in the form of paste, 1 to 2 lbs.).

**Dusting for peach scab.** H. E. THOMAS (*Virginia Sta. Rpts. 1915-16*, pp. 184-186, figs. 2).—A preliminary trial was made of a dry lime and sulphur mixture (1:8) on peach scab (*Cladosporium carpophilum*) at Blacksburg during the season of 1916. The applications were made with a power dusting rig from both sides of the row on June 29, July 14 and 31, and August 14, the amount averaging 0.8 lb. per tree for each application. The dust adhered well to the fruit, but not to the foliage.

The efficiency of the dust application was rated as remarkably high, considering that the scab had become well established before the first application was made. The mixture prevented the spread of the scab to noninfected fruit, 78.6 per cent of the fruit being clean on the dusted tree, as compared with 0.4 per cent on the check. It also checked the development on infected fruit or prevented reinfection, 73 per cent of the fruit on the check tree being lashed as heavy scab, as opposed to 0.1 per cent on the dusted tree. This treatment is therefore considered a promising means of control for peach scab.

**Fungus diseases [of cranberries].** H. J. FRANKLIN (*Massachusetts Sta. Bul. '80 (1917)*, pp. 186-193).—These investigations were conducted as in previous years (E. S. R., '80, p. 51) in cooperation with the Bureau of Plant Industry of the U. S. Department of Agriculture.

Comparison of the tabulated results of spraying experiments with Bordeaux mixture showed that as a rule the areas sprayed in 1915 were less productive in 1916 than were the checks, also that the fruit from the sprayed areas was inferior as regards keeping quality. Apparently injury from Bordeaux mixture weakens the resistance of the berries to disease. Blackleaf 40 solution (0.25 per cent) with fish-oil soap (2 lbs. to 50 gal. water) affected but little the quality of the fruit and showed no fungicidal value in the storage tests, but these experiments are not regarded as conclusive. Corona arsenate of lead (3 lbs. to 50 gal. water) gave little if any increase in yield, but an improvement was noted in the keeping quality of the fruit. Most of the rot in berries of the variety Early Black was found to be due to anthracnose (*Glomerella rufomaculans vaccinii*). Areas treated by putting copper sulphate in the flowage

showed no definite advantage, either in the quantity or in the keeping quality of the fruit.

False blossom was unusually abundant on the station bog this season, the moist conditions supposedly favoring greatly the development of *Exobasidium oxyacoccii*, the cause of this disease, which this year attacked blossoms as well as leaves.

Observations on the spoilage of cranberries due to lack of proper ventilation, C. L. SHEAR, N. E. STEVENS, and B. A. RUDOLPH (*Massachusetts Sta. Bul.*, 180 (1917), pp. 285-289).—Tests made with cranberries of several varieties from different sources kept in an atmosphere of nearly pure carbon dioxide resulted in the spoilage of almost all such berries, which also showed a dull red color. The controls kept in the air showed very little rot even at the end of two weeks. Confirmatory tests are described. Humidity appears to have no influence on the effect of the carbon dioxide, and the same is true of the different fungi present, which are usually also unfavorably affected by the carbon dioxide. The importance of ventilation is indicated.

Downy mildew in vines, H. E. LAFFER (*Jour. Dept. Agr. So. Aust.*, 29 (1917), No. 12, pp. 970-977).—In a report dealing with insect injury and reconstitution of vineyards in New South Wales, it is stated that for the first time in Australia grape downy mildew (*Plasmopara viticola*) has been identified in the vineyards of Victoria, the infected area being spread over some 400 square miles in the northeastern portion of the State. It is thought that the disease may possibly have been present for several years, but only in the past season have the frequent summer rains and other weather conditions favored sufficient development of conidiophores to enable the fungus to be identified with certainty. The development of the conidiophores is greatly increased by the proximity of even small areas of water surface, as dams or drains.

Citrus diseases, J. A. STEVENS (*Porto Rico Dept. Agr. Sta. Rpt.* 1917, pp. 78-83).—Notes are given on citrus scab due to *Cladosporium citri*, fruit rot caused by *Penicillium* spp. and *Diplodia* sp., crown rot of seedlings due to *Sclerotium rolfsii*, and on the parasitism of mistletoe (*Dendropemon* spp.).

Progress Texas is making toward the eradication of citrus canker, E. L. AXERS (*Bul. Agr. and Mech. Col. Tex.*, 3, ser., 3 (1917), No. 7, pt. 1, pp. 37, 38).—In an address to the Texas Farmers' Congress in 1916 the author stated that rapid progress had been made toward eradicating citrus canker. Though at one time scattered through the entire citrus-growing area of the State, this disease has been almost entirely confined to the three counties where it was first prevalent, and it is decreasing in that area.

Comparative studies on soils affected or not affected with gummosis.—I. The soil reaction, S. TIJMMSTRA (*Bul. Deli Proefstat.*, Medan, No. 9 (1917), pp. 41).—An extension of studies previously noted (E. S. R., 33, p. 22) is reported to have shown no distinct difference in reaction between soils carrying the infection responsible for gummosis and those which were free from such infection.

Melanose, II, H. E. STEVENS (*Florida Sta. Bul.* 145 (1918), pp. 101-116, fig. 7).—In continuation of a report made in connection with Floyd (E. S. R., 33, p. 651), the author states that melanose of citrus leaves, fruits, and young stems, previously shown to be due to *Phomopsis citri*, is found chiefly in dead twigs and branches. These constitute the principal sources for the spread of this disease, which does not extend itself from either foliage or fruit, though the fruit is subject to injury by this fungus during several months.

Removal of dead wood is thought to offer the most practical means at present available for reducing the ravages of melanose, which is thought to be the

most injurious disease attacking citrus fruits and to cause increasing loss each year in Florida.

*Diseases and pests of tea on the east coast of Sumatra*, C. BERNARD (*Dept. Landb. Nijv. en Handel [Dutch East Indies], Meded. Proefstat. Thee*, No. 54 (1917), pp. 1-15).—The author briefly discusses, along with animal enemies of tea, a Fomes causing root disease, also other causes of loss or injury, as red rust (*Cephalotrichus virescens*), brown blight (*Lactaria* sp.), gray blight (*Pestalozzia palmarum*), and sooty blotch (*Capnodium* sp.).

*Nematode diseases of narcissus*, J. RITZEMA BOS (*Tijdschr. Plantenziekten*, 23 (1917), No. 3, pp. 99-135).—The author describes a stem disease of narcissus ascribed to a nematode (*Tylenchus devastatrix*) which is said to be parasitic on many other plants. A list of these plants is given along with a discussion of the possible specialization of this nematode.

*Biological observations on *Puccinia vineae**, F. VINCENS (*Bul. Soc. Path. Veg. France*, 4 (1917), No. 1, pp. 30-36, fig. 1).—A brief account of study of *P. vineae* concludes with the statement that the teleutospores found on *Vineae major* will not cause infection of *V. minor*. From this fact it is inferred that there exist two biological species of *P. vineae*.

*A practical method of preventing the damping-off of coniferous seedlings*, C. A. SCOTT (*Jour. Forestry*, 15 (1917), No. 2, pp. 192-196, pls. 2).—A method said to be practical and highly satisfactory is described for sterilizing forest nursery seed beds with steam delivered at 120 to 160 lbs. pressure for from 35 to 45 minutes under inverted pans previously weighted down. This plan has stood the test of use for two seasons very favorable to the fungns causing the damping-off of coniferous seedlings, except in the case of the Engelmann spruce. The unsterilized beds of all species showed almost a total loss.

Germination in the sterilized beds occurred from two to four days earlier and was more nearly complete, giving a considerable saving in the cost of seeds. This method also destroys all weed seeds, thus eliminating the cost of weeding and counterbalancing thereby the entire expense of sterilizing the beds. The seedlings in the sterilized beds made a much more vigorous growth, attaining before the close of the growing season from two to four times the size of those on the untreated beds.

*Effects of mistletoe on young conifers*, J. R. WEIR (*Jour. Agr. Research [U. S.]*, 12 (1918), No. 11, pp. 715-718, pl. 1).—In the course of work done in the Bureau of Plant Industry on injury to conifers by mistletoes of the genus Razoumofskyi (Arceuthobium), in part noted previously (E. S. R., 34, p. 547; 35, p. 459; 37, p. 458), the author was able to demonstrate the suppression of growth in young trees by this parasite. In *Pinus ponderosa* the internodes as well as terminal and lateral buds of the main shoot were greatly reduced by the action of the mistletoe. In case of *Pseudotsuga taxifolia* the buds were greatly reduced, the food normally stored therein going elsewhere to form brooms and burls, this fact probably bearing an important relation to the stunting of the tree and a staghead appearance. The actual storage of food materials in mistletoe brooms became apparent in the production of needles on detached brooms kept in damp situations, normal branches showing very little disposition to throw out needles, though kept in the same damp, shady situation.

The author concludes that false mistletoes are seriously injurious to the young conifers in the forest, especially as these, when infected on the main stem (the usual way), do not recover so as to produce merchantable material. The young tree does not pursue the usual plan of excurrent growth in such cases. It may become practically a continuous witches' broom or else die

outright. All infected trees, especially those overtopping other trees, should be destroyed.

A disease of walnut due to *Armillaria mellea*, P. GUINIER (*Bul. Soc. Path. Veg. France*, 4 (1917), No. 1, pp. 27-29).—*Armillaria mellea* is noted as causing the death of walnut in certain regions which are named.

#### ECONOMIC ZOOLOGY—ENTOMOLOGY.

Report of the entomological department, J. TROOP (*Indiana Sta. Rpt. 1917*, pp. 39, 40).—The grape colaspis is said to have shown great activity in corn fields, particularly in the southern counties of Indiana. On one farm examined a field which had been in timothy the previous year was so badly infested that it had to be disked under and replanted, while in an adjoining field, which had been in wheat the previous year, no infestation could be found.

During June, 1917, several carloads of potatoes which were received in the Indianapolis market from Australia were found to be badly infested with the potato tuber moth.

Report of the entomological department, E. C. SMYTH (*Porto Rico Dep. Agr. Sta. Rpt. 1917*, pp. 99-106).—This statement of the work of the year deals particularly with plant inspection and quarantine and the fumigation of imported cane for grinding. The importance of preventing the introduction of the cane butterfly *Calisto archebates* in cane from Santo Domingo is again pointed out (E. S. R., 36, p. 753). In addition to the cane butterfly three beetles are annually intercepted by the hundreds through fumigation with sulphur dioxide, namely, the Santo Domingo cane weevil root borer (*Diaprepes quadrifasciatus*), the Santo Domingo cane weevil stalk borer (*Metamasius sericeus*), and a large black bisterid beetle that seems to work in cane, *Hololept quadridentata*.

Report of the assistant entomologist, R. T. COTTON (*Porto Rico Dept. Agr. Sta. Rpt. 1917*, pp. 107-122, figs. 8).—This consists largely of a report of investigations of several tobacco insects, including the tobacco leaf folder (*Pachyzancla periculalis*), the large tobacco suck fly (*Dicyphus luridus*), and the small tobacco suck fly (*D. prasinus*). A heavy infestation of slugs (*Vernicella lapa*) at the time of planting is said to have resulted in considerable damage to the young plants. This pest, however, is fairly easily controlled, the most effective and cheapest method consisting of collection with the aid of lanterns when they come out to feed at night. Flea-beetles, which are the worst insect pests of tobacco in Porto Rico, are being controlled by lead arsenate in powder form applied with small dust guns at the rate of 50 lbs. of arsenate of lead to 50 lbs. of dry, leached, wood ashes. Two plant bugs which are abundant in all sections of the tobacco district and damage the leaves were found to be new to science and have been described by Gibbs under the names *D. luridus* and *D. prasinus* (E. S. R., 37, p. 561), both of which have been studied and are here reported upon.

The tobacco leaf folder (*P. periculalis*) is of wide occurrence in Porto Rico and has been recorded as occurring in the United States and Brazil. It feeds exclusively on solanaceous plants, tobacco being its favorite among cultivated plants, although the weeds *Solanum torvum* and *S. nigrum* are undoubtedly its main food plants. It is abundant in all localities throughout the tobacco districts, but attacks the plants only when they are young and tender. The young larvae on hatching out commence to feed on the leaf near the midrib and after some growth form a feeding shelter by folding over a portion of the edge of the leaf and fastening it down with silk strands, within which the

ped, occasionally changing their quarters and folding the leaves in a fresh lace. The eggs, which are deposited singly on the underside of the tobacco leaves, hatch in from 5 to 8 days. During the next 18 or 20 days the larva molts four times at more or less regular intervals. At the end of this time it rolls itself up in a portion of the leaf and passes 3 days in the prepupal and 12 days in the pupal stage. Thus the life cycle from oviposition to the emergence of the adult varies from 35 to 44 days, with an average length of 39 days.

It is parasitized by both hymenopterous and dipterous parasites, including a unidentified egg parasite, a tachinid (*Argyrophylax albincisa*), and an ichneumonid (*Cheronus* sp.) reared from the larva, and a small braconid reared from the pupa. The pest is rather easy to control, it being held in check on plants that have been systematically dusted with arsenicals to control the flea-beetles, the destruction of wild host plants occurring in the vicinity of tobacco fields is recommended.

The large tobacco suck fly (*D. luridus*), the more abundant of the two important bugs found on tobacco, was first noticed by the author in the spring of 1910. At present it is known to occur only in Porto Rico where it is widely distributed wherever tobacco is grown. Tobacco is attacked by it in all stages of growth, the leaves being damaged, the plant weakened, and the quality of the leaf lowered. The eggs, which are inserted singly in the midrib of the tobacco leaves, hatch in from 6 to 10 days. There are five nymphal stages of more or less equal length, the total length of the life cycle from oviposition to the appearance of the adult varying from 25 to 38, with an average of 30 days. The damage caused by this pest at the present is not sufficient to warrant special treatment. The practice of keeping the ground free from the weeds which harbor it during the interval between crops is the most practical method of holding it in check.

The small tobacco suck fly (*D. prasinus*), while abundant on tobacco, is not so abundant as the larger species but on the tomato is found more frequently than is *D. luridus*. Its life history is very similar to the large tobacco suck fly and it is controlled in a similar manner.

Citrus insects mentioned include the large striped leaf-eating weevil (*Diaprepes spengleri*), which was exceptionally abundant during the month of May and did considerable damage to citrus foliage; *Solenopsis geminata*, which is a source of injury in some groves; and caterpillars of the orange *Papilio capilio androgeus*) and of the leaf-roller (*Earias thraso*) which were fairly common in some groves.

The difficulty experienced in making a good oil emulsion due to the inability to get a caustic potash soap led to experiments and the discovery of a method by which the soda or hard soap can be used in making an emulsion that will semi-solidify soon after it is made. It was found that an excellent emulsion that would remain in good liquid form for several days can be made in the following manner: Eight lbs. of soap (either Octagon or fish-oil soap) is dissolved in 2 gal. of water by heating. While hot 2 gal. of Corvus oil is slowly added and vigorously stirred. After the emulsion has been made, 0.25 lb. of ordinary cooking flour is added and thoroughly stirred, then 4 gal. of water added and the whole mixture again heated until it boils. The emulsion is then moved from the fire, 1 qt. of carbolic acid added, and is ready for use. For spraying it should be diluted at the rate of 1 part stock to 25 parts of water. How to combat rabbits, gophers, prairie dogs, coyotes, ants, and grasshoppers, A. L. PASCHALL (*Arizona Sta. Bul. 81 (1917)*, pp. 321-338, figs. 11).—practical summary of information.

[Work with cranberry insects in 1916], H. J. FRANKLIN (*Massachusetts Sta. Bul. 180 (1917)*, pp. 223-234).—The author reports that the beetles which infested cranberry roots the previous year (E. S. R., 36, p. 54) were reared to adults and identified as the cranberry rootworm (*Rhabdopterus picipes*), studies of which insect by Scammonell have been noted (E. S. R., 33, p. 456). The application of 2.25 lbs. of arsenate of lead and  $1\frac{1}{2}$  heaping teaspoonsfuls of white arsenic to 40 gal. of water applied on July 3 and repeated on the eleventh and eighteenth days appeared to have destroyed the beetles.

The submergence of the eggs and caterpillars of the gipsy moth for varying periods are reported upon. The results, together with observations of bog flooding, led to the conclusion that reflooding for the gipsy moth will be most satisfactory if done while the worms are small and before the largest are more than  $\frac{3}{8}$  in. long. The sooner it is done after all the eggs have hatched the less will be the damage from the feeding of the worms and the less the trouble from their floating ashore alive, as it appears to be the habit of the very young caterpillars to cling to their support when submerged. To be entirely effective, even when the worms are small, the flowage must be held for nearly 40 hours. A brief report of experiments by C. W. Minott on the wind dispersion of gipsy moth caterpillars on cranberry bogs conducted during May and June, 1916, is incorporated. Six cotton cloth screens in two sections, each section being 3 by 10 ft., to which tanglefoot was applied were located on bogs at distances from woodland infestations ranging from 400 to 1,200 ft. From one screen located at 600 ft. from infested woodland on the northwest and 900 ft. on the west, 62 small caterpillars were removed during the season, or slightly more than one to the square foot.

Observations of the season on the effect of resanding on the abundance of the cranberry tipworm (*Dysyncura vaccinii*) sustained the conclusions previously reported. A chalcidid (*Tetrastichus* sp.) and two prototrypids (*Aphanogmus* sp. and *Ceraphron* sp.) were reared from the larvae of the last brood after they had encased themselves in their cocoons.

In control work with the black-head fire worm blackleaf 40 at the rate of 1:400 to which was added resin fish-oil soap at the rate of 2 lbs. to 50 gal. of water failed to control the first brood entirely, but checked the pest sufficiently so that the plats remained green while the surrounding bog had turned rather brown. The application of nicotin sulphate appears at present to be the only really effective measure of controlling the first brood, two and perhaps three applications being advisable. As a treatment of the second brood it may have to compete with arsenate of lead, which is far more effective with the second brood than with the first.

The injury caused by the cranberry fruit-worm in 1916 was the least of which there is any record. Parasitism of its eggs by *Trichogramma minuta* ranged from 25 to 75 per cent on dry bogs and from none to about 75 per cent on those with winter flowage. Parasitism by *Phanerotoma franklini*, previously referred to as *P. tibialis*, ranged from 24 to about 55 per cent on dry bogs (without winter flowage) and from none to about 33 per cent on flooded ones. *Pristomeria agilis* was very scarce, the percentage of parasitism ranging from none to 5.5 on flooded bogs and from 4.5 to 10 on strictly dry ones. Submergence tests are reported, which seem to prove that the effect of submergence on the worms in their cocoons depends largely on the temperature of the water, and suggest that a flowage after picking if begun before October 1 and continued for 12 or possibly even 10 days may control this insect as well as late holding of winter flowage usually does. Under the heading of bog management the effect of late holding of a deep winter flowage, etc., are discussed.

The life history and control of the rose leaf-hopper.—An apple pest, Childs (*Oregon Sta. Bul. 148 (1918)*, pp. 3-32, figs. 14).—The occurrence of the rose leaf-hopper (*Empoas rosea*) in injurious numbers in several apple-growing sections of Oregon during 1912-13 led to the study of its life history and control by the author, here reported, commenced in 1914.

Since the extreme prevalence of the leaf-hoppers during 1912-13 no general infestation of all orchards has occurred in the Hood River Valley, but during both 1914 and 1915 younger orchards could be found swarming with these insects in summer and early fall and they were the source of much injury. The leaf-hoppers do not feed upon the fruit, their attacks being confined entirely to the under surfaces of the foliage and the extent of the injury is difficult to estimate. The studies have shown that there are two generations a year in the Pacific Northwest.

The winter is passed in the egg state in the canes of wild and cultivated rose, evergreen blackberry, the runners of the strawberry, and to a much less extent in the tissues of other berry plants. Very few overwintering eggs are found in apple twigs in the proximity of rose bushes. In 1915 the first overwintering eggs were found hatching on the rose on April 14, and the first nymphs were observed on the apple on April 19. On the rose the hatching progressed rapidly, being completed by May 1, but on the apple hatching was more gradual. Upon hatching out the young nymph wanders about in search of a leaf on the inside of which when found it settles and at once begins feeding. In 1915 the migration from the rose began June 1 and by June 6 large numbers, but very few remaining on rose bushes on June 8.

Oviposition by the summer generation occurs throughout the greater part of July and August, but toward the latter part of August they become fewer in number and by the first of September have practically disappeared. In 1915 the first nymphs of the second generation began hatching out on July 7, continued to increase until August 10, and had practically ceased by August 23. The average of the five nymphal periods of the first brood in May and June, 1915, was 7.3, 8.5, 5.7, 5.9, and 8.2 days, respectively, for 30 individuals, or total average nymphal period of 35.6 days. The average nymphal periods of the second generation during July and August for 33 individuals was 4.1, 4.4, 4.8, and 6.4, with an average total of 23.7 days. During August and September the length of the instars was somewhat greater, with an average total nymphal period for 14 individuals of 34 days. Breeding cage observations indicate that unmated individuals of the first generation may live as long as 116 days, and those of the second generation 129 days.

The species does not suffer to any great extent from parasitic enemies, an egg parasite (*Anagrus armatus*), which has been found to parasitize fully one-third of the eggs of the leaf-hopper, being the only insect that has been found to reduce the leaf-hopper materially. It has been found that in cases where the leaf-hopper has an opportunity to choose the most desirable host plants in which to deposit overwintering eggs 92.7 per cent of the eggs are deposited in the canes of the rose. It is believed that if rose bushes and edges are properly trimmed and sprayed before the insects become winged such success in keeping down the numbers of insects in apple orchards will result.

"The use of lime-sulphur in the 10-day and 30-day scab sprays has been found effective in controlling the first generation in apple orchards. The spray has to be applied while the insects are in the first to third nymphal stages in order to be effective. After this period blackleaf 40 (1:1,200) plus lbs. of soap to 100 gal. of water has been found satisfactory in destroying

the hoppers. On roses blackleaf 40 (1:2,000) plus 5 lbs. of soap to 100 gal. of water is effective when applied to insects in the first to third stages of their growth. For insects in the last two stages of their development increase the blackleaf 40 to 1:1,200. All sprays should be directed upward, in order to strike the insects, which are all located on the under surfaces of the leaves."

A list of 25 references to the literature is included.

The aphid of chokecherry and grain (*Aphis pseudoavenae* n. sp.), EDITH M. PATCIN (*Maine Sta. Bul.* 267 (1917), pp. 293-297, fig. 1).—Under the name *A. pseudoavenae* n. sp. the author describes a plant louse which resembles *A. avenae* morphologically but the fresh colonies which crowd close along the stem and ventral leaf suggest at once the *A. rumicis* group, on account of the conspicuous areas of wax powder, and can not be mistaken for *A. avenae* in life.

The species was found late in June, 1917, heavily infesting a group of chokecherries on the campus of the University of Maine and specimens had been collected at Fort Kent, Me., July 6, of the previous year. Progeny of the winged June migrants were placed on various grasses, and found to accept timothy, Kentucky blue grass, sheep fescue, meadow fescue, redtop, barley, and oats.

Technical descriptions are given of its several forms. The author points out that this species is not the *A. avenae* of American authors or of Theobald, nor the *A. padi* described and figured by Koch and Buckton. It is thought that it may possibly "in part" be the *A. padi* of Van der Goot, although it does not accord with his collection from *Mespilus* and *Pyrus malus*.

The European corn borer (*Pyrausta nubilalis*).—A recently established pest in Massachusetts, S. C. VINAL (*Massachusetts Sta. Bul.* 178 (1917), pp. 137-152).—The author records the recent introduction and establishment of this well-known European pest in the vicinity of Boston and gives a preliminary account of the present status of knowledge of it, based upon a review of the literature and observations by the author.

In work during the summer of 1917 many corn plants were found by the author to be tunneled by this borer. During July nearly every infested plant could be readily detected through having its tassel broken over and hanging pendent just above the first two or three spikes, as a result of the larvae tunneling in the pith of the main tassel stalk, so weakening it that it was readily blown over by the wind. The species is widely distributed in Europe and Asia, having been reported in literature as occurring in central and southern Europe, west central and northern Asia, and Japan, in which localities its food plants consist of corn, hemp, hops, millet, and several wild grasses. Corn and hop plants are severely damaged by it, 50 per cent of these crops being destroyed in some sections of central Europe. Of its several food plants hemp is the only one offering ideal conditions for its importation. It is thought probable that plants infested by it were cut and shipped during the fall and winter months to a cordage company in the vicinity of Boston, and the hemp not having been used at once the larvae transformed to pupae in early spring and soon emerged as moths.

Early sweet corn grown in market gardens 10 to 12 miles inland has been seriously attacked by this pest for the past three or four years and from this the author infers that the pest was imported about 1910. At the present time the area of infestation is approximately 100 square miles in extent and is located immediately north and northwest of the city of Boston. Sweet corn is the only valuable commercial crop seriously attacked by it there, since the other food plants are not grown. The most commonly infested weeds and

grasses are barnyard grass, pigweed, and foxtail grass. Dahlia stems are also injured.

With the exception of the leaf blades the whole corn plant above ground is subject to the attacks of these voracious caterpillars. After emerging from the egg the larvae commence feeding on the unopened staminate flowers borne by the tassel or immediately pierce the sheath near its junction with a node. Those which feed on the tassel bore a hole in the side of the buds and feed on the internal succulent parts. Soon these small caterpillars leave the tassel buds and enter the tassel stalks, or terminal internode, where they tunnel through the pith and finally complete their larval life in this internode. These tunnels so weaken the terminal internode that it soon becomes broken over, a type of injury which is especially noticeable on the early corn crop. It is quite evident that this injury indirectly affects the formation of corn on the cob by destroying the pollen necessary for fertilizing the corn silk.

Those larvae which do not feed on the tassel immediately pierce the sheath surrounding an internode, usually where the edges overlap at its junction with a node. Here they feed on the internal surface of the sheath, excavating a groove halfway around the stalk, and then bore directly into the pith where they form long winding tunnels. Whenever the larvae during their tunneling operations reach a node, a rather large cavity is usually formed. From this cavity the larvae sometimes bore through the node, but more often they turn and tunnel in the opposite direction in the originally infested internode. At the termination of the feeding period nearly all of the central portion of the stalk has been eaten, and this so weakens the plant that a strong wind is likely to break over the stalk, thus completing the destruction commenced by the caterpillars.

A number of these stalk-boring larvae very often attack the small stalk or pedicel bearing the ear, and in some cases may bore directly through this into the developing ear. This injury to the pedicel causes the ear to wither and die.

The most serious damage to the crop is caused by the large percentage of the second brood larvae which immediately enter the ear after hatching. The injury by this brood to the corn ear is very similar to that caused by the well-known corn ear worm (*Chloridea obsoleta*). Besides feeding on the kernels in a similar manner to the corn ear worm, the European corn borer exhibits characteristic tunnelling habits and bores through the cob.

A brief summary is given of its life history, the details of which have not been worked out. There are two broods a year, hibernation taking place as full-grown or nearly full-grown larvae within their tunnels in the cornstalks, and in some cases in the cob. These larvae pupate in the spring and emerge as moths, probably the latter part of May. "Soon after emergence the females begin laying eggs on the cornstalks, and in a few days these hatch. The young larvae begin feeding at once, and quickly eat their way through the sheath before they tunnel in the main stalk.

"On reaching maturity, which occurs the latter part of July, the larvae clear out a portion of the burrow, prepare an opening through which the adults can escape, and after spinning a thin silken partition across the top and bottom of this cleared space, transform to pupae. The moths emerge for the second brood in about two weeks. This brood of larvae becomes full grown by late fall, but does not transform to pupae at once as in the first brood. Instead, the winter is passed as larvae within the stalks."

There appears to be no means of destroying the pest during the summer through the use of insecticides since all of its transformations take place within

the plant. The principal means of control lies in the possibility of establishing a system of cultural methods which will prevent the injury. Since the winter stage is passed in the food plant, control measures consist in burning the stalks during the fall and winter, burying the stalks, or feeding the stalks before emergence takes place in the spring. The importance of cooperation in control work is emphasized as a few neglected stalks are likely to harbor enough borers to infest the spring crop severely.

**Cankerworms.**—Life history and control of this orchard and shade-tree pest, W. H. GOODWIN (*Mo. Bul. Ohio Sta.*, 3 (1918), No. 3, pp. 89-92, figs. 2).—A popular summary of information on cankerworms and measures for their control.

It is stated that counts made of eggs in about 600 clusters collected in north central Ohio the latter part of March, 1916, gave an average of 131 eggs per cluster. Counts made of several hundred clusters collected during 1917, in which year the weather during oviposition was unusually favorable, gave an average of 258 eggs per cluster.

The biology of the alder flea-beetle (*Altica bimarginata*), W. C. Woods (*Maine Sta. Bul.* 265 (1917), pp. 249-284, pls. 3).—This flea-beetle, described by Say in 1824, has appeared in Maine periodically in enormous numbers, but notwithstanding its wide distribution, occurring as it does from Maine to California, no detailed work on its life history appears to have been published.

Of the outbreaks in Maine that of 1914 appears to have been the most severe, the leaves having been riddled by attacks of hibernating adults even before the larvae appeared. By the middle of August of that year practically all the leaves of every alder bush at Orono attacked had been skeletonized by the larvae and the trees looked brown and bare as though swept by fire. There was a great reduction in the number of beetles appearing the following year, and in 1916 this beetle was so rare that no larvae and but a single adult could be found at Orono, for which extraordinary disappearance the author is unable to offer any satisfactory explanation.

In nature the flea-beetle is confined almost entirely to the leaves of the alder, the only other plant on which the author has taken it being the willow (*Salix rostrata*). There is, however, a biological race of this species which occurs on balsam poplar at Veazie, Me., the larvae and adults of which eat alder or willow as readily as they eat balsam poplar. The forms taken on alder, however (both larvae and adults), have been tested many times on the leaves of balsam poplar but with negative results.

As with the greater number of other chrysomelids this beetle hibernates as an adult, seeking winter quarters in Maine late in September and emerging the following spring as soon as the alder leaves are well expanded. The yellow eggs are deposited from mid-June to late July in clusters on the foliage. The larvae hatch out in from 7 to 10 days and feed upon the leaves, which they skeletonize. The average duration of the three larval instars is 6.3, 8.0, and 13.2 days, respectively; that of the prepupal period 7 days, and of the pupal period 10.2 days. Before pupating the larvae enter the ground to form their pupal cells.

Technical descriptions are given of the several stages, together with details of life history studies.

Its natural enemies include the parasitic fungus *Sporotrichum globuliferum*, to whose attack all stages, except the egg, are susceptible, and a tachinid, *Hyalomydas triangularis*, reared by the author from the adult beetles. Although the author has had no occasion to conduct control work there is no reason to suppose that the measures employed in combating other flea-beetles, especially a thorough spraying with arsenate of lead at the rate of 3 lbs.

paste form) to 50 gal. of water as soon as the beetles appear in the spring and repeated in late June and mid-July for the larvae, where necessary, will control it.

The bulletin concludes with a discussion of its synonymy in which it is pointed out that the generic name *Altica* holds by priority.

A 5-page bibliography is included.

Bark beetles infesting the Douglas fir, W. J. CHAMERLIN (*Oregon Sta. Bul.* 47 (1918), pp. 5-40, figs. 15).—In this account of studies of bark beetles of the superfamily Scolytoldea a key is first given to the families of which there are three (Ipidae, Scolytidae, and Platypodidae) and their subfamilies, of which here are five of the former and one each of the two latter.

In considering the several species, of which there are 22, descriptions are first given of the adult, etc., followed by notes on distribution, hosts, biology, and economic importance. The Douglas fir bark beetle (*Dendroctonus pseudotsugae*), *Eccoptogaster unispinosus*, *Pseudohylesinus grandis*, *P. nebulosus*, *Ylycorus xylographus*, and *Typhodendron lineatus* are the species of which the more extended accounts are given.

The greenhouse red spider attacking cucumbers and methods for its control (*Tetranychus bimaculatus*), S. C. VINAL (*Massachusetts Sta. Bul.* 179 (1917), pp. 153-182, fig. 1).—Numerous inquiries received from market gardeners in regard to the control of the red spider attacking greenhouse cucumbers in Massachusetts led to the investigation here reported. This spider mite is the most widely distributed and destructive pest of greenhouse cucumbers, being particularly injurious in the market-garden district of Boston. It is estimated that the annual loss to cucumber growers in this district through red spider injury amounts to approximately \$150,000, or 10 per cent of the whole crop.

The greenhouse vegetables most subject to attack are cucumbers, eggplants, and tomatoes. Greenhouse flowers subject to attack are roses, violets, sweet peas, carnations, chrysanthemums, etc. Plants in the vicinity of greenhouses subject to attack are beans, eggplants, celery, tomatoes, strawberries, clover, grasses, and weeds.

Experimentation on the control of this mite attacking cucumbers gave no fumigant which could be used with safety to the foliage. Sulphur burned to form sulphur dioxide proved to be very effective in killing all stages of mites. Although this gas is deadly to plant life, its application as a fumigant to rid empty greenhouses of red spiders is extremely useful.

Many spray mixtures proved to be efficient in controlling actively feeding mites, but did not affect those in quiescent stages of development. For the control of all stages above the egg stage linseed oil emulsion proved to be most satisfactory. The control of the red spider may be accomplished by combining preventive and repressive measures. Clean culture, or the eradication of weeds and plants which harbor mites during the winter period, either within or outside the greenhouse, is by far the most vital means of prevention in cucumber greenhouses. Dispersion within the greenhouse may be hindered by destroying plants or parts of plants which harbor the initial infestation.

“Applications of linseed oil emulsion at weekly intervals during the early life of the plant prove very effective if made with extreme care. At least three applications must be made for an efficient control. By checking red spider infestation early in the season the producing period of the plants is lengthened approximately one month.”

The formula given for the linseed oil emulsion for 100 gal. of spray is 5 gal. of hot water, 1.5 lbs. of Ivory soap, and 1 gal. of raw linseed oil.

## FOODS—HUMAN NUTRITION.

The limiting factors in the food supply of the nation at war, A. E. TAYLOR (*Johns Hopkins Univ. Cire., n. ser., No. 2 (1918), pp. 5-24*).—In this treatise the author sets forth the problems of war-time food supply. It is pointed out that more food must be produced or less consumed.

"Increased production of foodstuffs is as much a military necessity as increased production of explosives. Reduced consumption of foodstuffs in certain directions, in order to fulfill . . . [the] obligations [of the United States] to . . . [her] Allies, is as much a war measure as sending military forces to France. . . .

"The limiting factors in cultivation of the soil and husbandry are climate, capital, labor, fertilizers, seed, machinery, and transportation."

Women are urged to undertake farm labor; also the making of war gardens.

"Confronted with a large increase in . . . consuming population through having assumed the feeding of a portion of the allied peoples, reduction of consumption becomes a direct necessity."

Hoarding and waste are two factors that increase consumption unduly.

"Repression of ingestion is the final step in the conservation of food." . . .

"Without going to the limit of bearable repression of intake of food, it is clear that a people may safely reduce the consumption of food 25 per cent—this including reduction of waste and repression in intake. . . . Of course, . . . strongest efforts [must be exerted] for increased production, but . . . [it must be] expected to supplement these by the savings achieved through reduced consumption. . . .

"Repression in the consumption of food can not be successfully accomplished without repression in the use of other commodities. . . . Food [can not be saved] unless there is a saving in luxuries. . . . There is no saving of food without the possession of a sacrificial consciousness."

The nutrition of the child (*Bul. Kans. Bd. Health, 13 (1917), No. 9, pp. 199, 200*).—This is a portion of an article entitled The Worth of a Child. The conclusion is reached that the high cost of living and uncertainty as to what substitution to make in the dietary of the family has led to defective and deficient feeding and that already young children in parts of America are feeling the stress of the war. The importance of maintaining the milk ration is pointed out.

The diet of prisoners of war in Germany, A. E. TAYLOR (*Jour. Amer. Med. Assoc., 69 (1917), No. 10, pp. 1575-1582*).—Details concerning the management of German prison camps are given. In theory, the prisoner of war is supposed to receive the ration of the army of his country, and this is, with his pay, charged against his country to be paid at the close of the war.

Two weekly diet sheets are presented which illustrate the subsistence in the German prison-of-war camps. The first, which is typical of the period prior to stringency of foodstuffs, calls for a per diem ration per prisoner of 89 gms. protein, 30 gms. fat, 510 gms. carbohydrate, with a total yield of 2,740 calories. The second diet sheet reveals the fact that during the period of stringency in foodstuffs prisoners were receiving per diem but 57 gms. of protein, 21 gms. of fat, 310 gms. of carbohydrate, and a total yield of 1,720 calories.

The author comments that "the intake of the prison-of-war camps in Germany since June, 1916, must have meant subnutrition for all of the nonworking men who had no other food supply, and death directly and indirectly to some." "It is apparent that our Government must undertake and organize the feeding of Americans who may be taken prisoners of war and confined in Germany." Food parcels can now be sent in via Berne or Copenhagen.

"My money won't reach:" The experience of 377 self-supporting families in New York City in endeavoring to make their incomes provide the essentials for healthful living, EMMA A. WINSLOW (*New York: Committee on Home Econ. Charity Organ. Soc., 1918, pp. 22*).—The results of an investigation by the Committee on Home Economics of the Charity Organization Society of the City of New York are reported.

"The food readjustments among the families seem to have been practically the ones which are normally made under economic pressure. Meat, milk, butter, eggs, fruits, and vegetables were reported as being used in much smaller amounts, and frequently certain or even all of these foods were left out of the diet completely. Bread, macaroni, tea, and coffee were being often used in increasing amounts, supplemented to a larger or smaller degree by other foods according to the amount of money available for food and the family's personal likes and dislikes."

The data concerning milk consumption are specially interesting in view of the present milk situation. The number of families reporting the use of the same amount of milk as formerly, although often a cheaper grade, and those reporting the use of less milk than formerly or none was about the same.

There seems, because of their lessened use of other foods, in many families, to be a radical increase in bread and macaroni consumption as a greater use of bread or macaroni is deemed the best way to feed a family when every penny must be considered. With income and living costs in more nearly their normal relationship and with a certain amount of educational guidance, it would seem to be a simple matter to have such families return to a wider use of milk, eggs, fruits, vegetables, and other foods not equally to be conserved, thus automatically using less bread.

"Food waste among the groups is negligible."

Is the table d'hôte meal wasteful? (*Hotel Mo., 26 (1918), No. 391, p. 88*).—The custom followed by successful table d'hôte caterers in the choice of dishes offered to patrons in this type of meal is discussed, the conclusion being that this type of meal is the more economical if well planned and without too great a choice of dishes.

Iroquois foods and food preparation, F. W. WAUGH (*Canada Dept. Mines, Geol. Survey Mem. 88, pp. 235, pls. 39, figs. 2*).—Present-day Iroquois food customs and those that have been practiced within the memory of the older people now living on the reservations are selected for this discussion. Of special interest are the methods of food preparation and recipes given for corn as well as for many other foods. References are made to the literature and anthology of the subject.

Aquatic products as food, H. F. MOORE (*Amer. Food Jour., 13 (1918), No. 1, pp. 21, 22*).—This article points out the real value of aquatic products as food and urges the public to become better acquainted with their merits.

Use potatoes to save wheat (*U. S. Dept. Agr., Office Sec. Circ. 106 (1918), pp. 6*).—This circular, consisting mainly of recipes, tells especially how to use potatoes in place of flour.

The Girasole or Jerusalem artichoke, a neglected source of food, T. D. A. COCKERELL (*Sci. Mo., 6 (1918), No. 3, pp. 260-269*).—The origin and cultivation of the Jerusalem artichoke and its possibilities as human food are here discussed. Directions for cooking are given.

The bread supply of Fargo, R. E. REMINGTON (*North Dakota Sta. Spec. Bul., 3 (1918), No. 1, pp. 14-16*).—Attention is called to the great variation in weight of the loaves sold by bakeries in Fargo, N. Dak. Individual loaves from the same baking and selling for the same price were found to vary in weight from

15 to 18 per cent. The average weight of the 10-ct. loaf was proportionately higher than for the 15-ct. loaf in all bakeries. Analyses of the various samples are reported.

Baking experiments with so-called egg substitutes (*Bul. Kans. Bd. Health*, 14 (1918), No. 3, pp. 36, 37).—In experiments made with several so-called egg substitutes it was found that a true sponge cake, one in which no baking powder is used, can not be made by substituting half the number of eggs with the commercial egg substitutes tested.

It is pointed out that the average weight of the dried edible portion of a hen's egg is about 0.5 oz. A teaspoonful of most of the so-called egg substitutes, which the manufacturers claim to be equal to 1 egg in baking and cooking, weigh only about 0.1 oz., or one-fifth that of the dry matter of 1 egg.

Averaging the selling price of seven commercial egg substitutes, it is calculated that the consumer is paying more per pound for the substitutes than he would pay for the dry material of hen's eggs at 40 cts. per dozen. The substitutes are chiefly starch, 70 to 90 per cent, while the dried matter of eggs is essentially protein and fat. Analysis of one brand showed that while the claim was made that the contents of the package was equivalent to 12 eggs, on a basis of protein value it was equal to only 1.7 eggs, in fat value to 0.14 of 1 egg, and in fuel value to 2.6 eggs.

"It would seem that the manufacturers of many of these so-called egg substitutes are exploiting the names of highly valuable and high-priced food to further the sale of their product."

Sugars other than cane or beet, G. L. TELLER (*Amer. Food Jour.*, 13 (1918), No. 1, pp. 23, 24).—The distribution in common food materials of sugars other than sucrose is here discussed. Only those sugars that are of commercial importance are mentioned—invert sugar, dextrose and levulose sugars, maltose, glucose, and lactose.

Milk from Fargo restaurants, E. F. LADD and ALMA K. JOHNSON (*North Dakota Sta. Spec. Bul.*, 5 (1918), No. 1, pp. 18, 14).—Analyses of the milk served in some of the Fargo (N. Dak.) restaurants are reported.

[Miscellaneous analyses of food and drug products], E. F. LADD and ALMA K. JOHNSON (*North Dakota Sta. Spec. Bul.*, 5 (1918), No. 1, pp. 18-20).—Analyses are reported of an egg substitute of which 46.25 per cent consisted of starch and vegetable tissue, and of two proprietary drug preparations.

A comparison of the effects of breakfast, of no breakfast, and of caffeine on work in an athlete and a nonathlete, I. H. HYDE, C. B. ROOT, and H. CURL (*Amer. Jour. Physiol.*, 48 (1917), No. 3, pp. 371-394).—Two subjects, one an athlete and the other a nonathlete, were observed and tests made of the pulse rate, blood pressure, ergographic, and ergometer work in both men under the following conditions: With certain doses of caffeine without breakfast, breakfast without caffeine, neither breakfast nor caffeine, and of different intervals of time following the partaking of caffeine or breakfast. Some of the results of the experiments recorded may be summarized as follows:

The ergographic work had practically no effect on blood pressure and only a slight effect, if any, on the pulse rate of either subject when working either without or after eating breakfast. The normal pulse rate was practically the same, but the normal blood pressure was higher at all times in the athlete than in the nonathlete.

The efficiency of both subjects grew in proportion to the interval between the meal and the beginning of work—from 1 to 2½ hours.

The increase above the normal blood pressure after working either with or without breakfast was the same for both subjects notwithstanding the

athlete did more work. Under the same conditions the pulse rate in the athlete was practically double that in the nonathlete. The increase in heart rate was least in both subjects when working 2½ hours after eating breakfast, that is, when the greatest amount of work was accomplished.

A weak dose of caffeine (1.42 grains), without work or breakfast, gradually increased the pulse rate during the first hour, but in the nonathlete, as a rule, only after a slight initial fall. In both subjects the pulse returned to normal rate within 3 hours. With a larger dose, 2.24 grains, under the same conditions, the increase in pulse appeared more promptly, but in 30 minutes was depressed below normal in the nonathlete and accelerated above the normal rate in the athlete. The blood pressure rose above the normal level in 1 hour and frequently had not returned to the level in 3 hours after taking either of the doses of caffeine.

The effects of caffeine taken at different intervals before work varied with the dose and the individual. The athlete did little more work 45 minutes after than he did 20 minutes before taking the drug. The nonathlete did two and one-half times as much work 3 hours after as he did 20 minutes after taking the dose.

Power and endurance for work and cardiac activity and increase in blood pressure did not keep pace with increase of dosage. The maximum power for work in both subjects was attained with the dose of 2.24 grains of caffeine. With this dose both subjects did two and one-half times as much work as they were able to do 1 hour after eating breakfast.

A stronger dose of 3.58 grains depressed the muscular power for work in both men, but very markedly so as well as the blood pressure and pulse rate in the nonathlete. In the athlete the blood pressure was no different but the heart rate was less after the work following the weaker dose.

When the dose was given in proportion to body weight, 0.2 grain of caffeine per 9.3 kg. of body weight or a stronger dose of 0.2 gm. per 5.9 kg. weight, the weaker dose stimulated the working power the more, but in the nonathlete the reverse was the case. It was found that for each subject there was a definite optimum dose, which when increased proved depressing for muscular work, blood pressure, and pulse rate.

One hour's rest did not remove the sense of fatigue produced by ergometer work, but when caffeine was taken the fatigue of the previous hour's work was inhibited and both subjects did more work then and even 24 hours after taking the caffeine than they did before taking the drug.

Increased irritability was noticed with the large dose of caffeine.

The influence of thyroid feeding upon carbohydrate metabolism, S. KURIYAMA (*Amer. Jour. Physiol.*, 43 (1917), No. 4, pp. 481-496).—Thyroid feeding experiments were made upon laboratory animals (rats and rabbits) to determine the influence upon carbohydrate metabolism. The following results are given:

Fresh thyroid gland of pigs or the desiccated thyroid used, administered by mouth in doses of 3 to 5 gms. (fresh) or 0.5 to 1.7 gm. (desiccated) per day, "decreased the glycogen content of the liver of white rats distinctly in three to five days. Control animals, fed on the same diet with the addition of muscle tissue or egg, do not show any such change, even when the food amount is regulated so that they lose as much in body weight as the thyroid-fed animals. The influence of thyroid feeding upon liver glycogen can be very easily removed by omitting thyroid from the diet. The liver shows its normal glycogen content two or three days after the cessation of thyroid administration, even when the loss of body weight has not been regained. This phenomenon seems to show

that the changes resulting from thyroid feeding and causing the loss of liver glycogen are not of a serious morphological nature.

"When dextrose is introduced parenterally to fasted rats which show a very low glycogen content of the liver the amount of liver glycogen increases markedly in a few hours. This does not seem to be the case in the thyroid-fed rats. Experimental hyperthyroidism does not change the sugar content of the blood in either rats or rabbits. Spontaneous glycosuria does not result from thyroid feeding in either rats or rabbits. The tolerance of thyroid-fed rabbits for dextrose, parenterally administered, does not differ from that of normal animals. Nearly the same degree of hyperglycemia and glycosuria can be induced by epinephrine injection in thyroid-fed as in control rabbits. The adrenal gland of thyroid-fed rats contains approximately the same amount of epinephrine as that of normal rats."

A bibliography is appended.

**Pellagra: Its nature and prevention.** J. GOINNERSER (*Pub. Health Rpts.* [U. S.], 33 (1918), No. 14, pp. 481-488).—In this paper the symptoms, cause, and cure of pellagra are discussed, and an attempt is made to answer, as simply as possible, the more important questions which the public frequently asks in regard to pellagra.

It is maintained that the right kind of a diet will keep people from having the disease and will cure those who have it if the cases are not too far advanced. In order that a proper balance may be assured, the diet should include, besides the cereals, starches, sweets, and fats, a sufficient quantity of milk or some lean meat and an abundance of green vegetables and fruit, and preferably some of all of these classes of foods.

#### ANIMAL PRODUCTION.

**Values of commercial feeding stuffs based on the net energy.** C. W. HOMMEL (*Virginia Sta. Rpts.* 1915-16, p. 200).—Based on the net energy of different feeding stuffs as shown by Armsby (E. S. R., 36, p. 367), a table is given of comparative values of feeding stuffs. The table is intended to enable feeders of cows and beef animals to transform market quotations of feeding stuffs into comparative feeding values on a money basis, to choose the cheapest feeds from a number of quotations, and to determine when a farm crop can be sold and replaced with a cheaper feed. The table also shows the digestible true protein in the various feeding stuffs.

**Fish wastes for feeding animals.** J. M. BARTLETT (*Maine Sta. Bul.* 236 (1917), pp. 291, 292).—Results of analyses of raw and air-dried samples of fish wastes from sardine factories are tabulated. The samples show great variation in composition, due largely to difference in water content. When reduced to an air-dry condition, carrying approximately 10 per cent of water, the composition was more uniform. On this basis the samples showed from 43.03 to 51.19 per cent of protein and 13.83 to 24.15 per cent of fat, but the oil content was too high to be safe for feeding except in small quantities. It is stated that fish meal containing only 2 to 4 per cent of oil and 3 per cent of salt can be safely fed, but larger amounts of oil may cause a fishy taste in the meat products. The phosphate of lime found in fish meal is deemed a valuable adjunct in feeding animals.

**Commercial feeding stuffs.** R. O. BARD (*North Dakota Sta. Spec. Bul.*, 5 (1918), No. 1, pp. 1-12).—Information is given concerning the ingredients guaranteed and the mineral content and other constituents identified in the examination of a number of live-stock and poultry tonics. Tabulated analyses are also reported for a number of feeding stuffs, including meat scrap, meat meal, tankage, linseed meal, cottonseed meal, and mixed and proprietary feeds.

The feeding-stuffs control law and how to comply with it, E. G. TROUX (*Indiana Sta. Circ. 75 (1917)*, pp. 8).—This circular gives the full text of the Indiana feeding-stuffs law as passed in 1907 and amended in 1909. The law is discussed and information given on its administration and the regulations of the State chemist's office covering the sale of concentrated commercial feeding-stuffs.

[*Sorghum for live stock*], C. C. CUNNINGHAM and R. KENNEY (*Kansas Sta. Bul. 218 (1917)*, pp. 48-52).—The average composition of sweet and grain sorghum seed is tabulated and compared with that of corn and corn-and-cob meal. In a feeding test with five lots of 10 pigs each a comparison was made of Kafir corn, milo maize, feterita, kaoliang, and corn, the daily ration consisting of 4.9 lbs. of one of these ground grains supplemented with 2.3 lbs. of shorts and 0.4 lb. of tankage per head. On these feeds the daily gains per head were 14.1, 14.3, 13.6, 13.1, and 14.6 lbs., respectively; and the concentrates required per pound of gain, 5.34, 5.23, 5.49, 5.72, and 5.14 lbs., respectively. In two other tests with pigs sweet sorghum seed proved decidedly inferior to corn, Kafir corn, and milo maize. The feeding value of the three latter grains varied but slightly.

Corn and Kafir corn were compared in fattening lots of 15 calves each. On 11.4 lbs. of corn, 1.79 lbs. of cottonseed meal, and 17.05 lbs. of sorghum silage, and 4.5 lbs. of alfalfa hay for two months of the 180 days' test, one lot of the calves gained an average of 1.96 lbs. per head daily and required 6.74 lbs. of concentrates per pound of gain. In the other lot, on the above ration, except that an equal weight of Kafir corn replaced the corn, the calves gained an average of 1.74 lbs. per head daily and required 7.63 lbs. of concentrates per pound of gain.

For fattening lambs 0.8 lb. of shelled corn, supplemented with 0.19 lb. of cottonseed meal, 1.36 lbs. of alfalfa hay, and 1.09 lbs. of sweet sorghum silage produced an average of 0.4 lb. of gain per head daily and required 2.69 lbs. of concentrates per pound of gain. When 0.9 lb. of shelled Kafir corn replaced the corn in the above ration the lambs gained 0.34 lb. per head daily and required 3.08 lbs. of concentrates per pound of gain. A third lot, fed 0.9 lb. of Kafir-corn meal and the above supplements, gained an average of 0.36 lb. daily and required 3.03 lbs. of concentrates per pound of gain.

In two tests in which corn and sweet sorghum silage were compared as a feed for dairy cows, the former produced 3 per cent more milk and 1 per cent more milk fat than the latter.

During 1912, 1913, and 1914 corn silage, Kafir-corn silage, and sweet sorghum silage were compared for the maintenance of calves. In addition to the silage the rations consisted of 1 lb. of cottonseed meal in 1912 and 1914 and 1 lb. each of corn and linseed meal in 1913. The average daily gains were 1.15 lbs. on corn silage, 1.25 lbs. on Kafir-corn silage, and 1.08 lbs. on sweet sorghum silage. It is stated that the above seasons were more favorable for the production of sorghum than for corn.

New facts on feeding cattle for successful growth and reproduction, E. B. HART, H. STEENBOCK, and G. C. HUMPHREY (*Wisconsin Sta. Bul. 287 (1918)*, pp. 3-24, figs. 20).—A summary is given of experiments which have been noted from other sources (E. S. R., 33, p. 367; 37, p. 766) on the effect that rations balanced from restricted sources may have upon growth and reproduction in cattle. The results of the station's recent work along this line in nutrition are discussed in their bearing upon the prevailing theory of balanced rations.

It has been shown that a ration made from the corn plant will be found safe in every respect for a growing and reproducing heifer. On the other hand,

the wheat plant can not be relied upon to furnish adequately the nutrients needed for such an animal. The mineral content of the straw will in all likelihood be too low in quantity. In addition, the grain carries a toxic material tending to pull the animal down. Wheat grain and wheat straw can be fed with alfalfa hay or corn stover and probably other good roughages, such as clover hay, thereby supplying the mineral deficiency and at the same time aiding greatly in overcoming the toxic effect of the wheat grain. Rations made wholly from the oat plant will be incomplete, and the offspring produced by the continued use of such a ration will be dead or weak. The straw is the disturbing factor, furnishing in most cases an inadequate mineral mixture. Mixed with some corn stover or legume hay the ration will be wholly sound for the production of strong calves. When the production of weak offspring through improper rations exists, the use of good roughages will solve the problem.

"The necessity of considering such factors as toxicity, suitable protein, growth-promoting substances or vitamins, and a proper balance of salts indicates how complex the problem of nutrition really is and how necessary it is that the relative importance of the factors be clearly exposed in order that we may place the various feeds in their proper category."

Raising beef cattle, R. O. Steverson (*Pennsylvania Sta. Bul. 150 (1918)*, pp. 3-10, figs. 11).—A summary is given of work from November, 1914, to July, 1917, of the investigations under way at the station on the feeding and management of beef-breeding herds under Pennsylvania conditions (E. S. R., 3, p. 168). During this period 20 pure-bred cows were used, lot 1 consisting of 10 Shorthorns and lot 2 of 10 Aberdeen Angus. The object was not to make a breed comparison, but to have representatives of a standard breed of beef type. During the summer the cows, calves, and growing stock were pastured without extra feed. During the winter corn silage was the sole roughage of the cows and growing cattle. In addition, the cows in lot 1 were fed 1 lb. of linseed meal per head daily, and those in lot 2, 1 lb. of cottonseed meal. All growing calves designed for breeding were fed silage and 3 lbs. of cottonseed meal per 1,000 lbs. live weight. Fattening stock was fed corn meal and mixed hay or alfalfa hay in addition to corn silage and cottonseed meal.

During the three winters, 1914, 1915, and 1916, in a basement barn with the south side removed, the cows in lot 1 lost an average of 29.34 lbs. each per winter, and were wintered at an average net cost of \$22.97. The cows in lot 2 lost an average of 8.12 lbs., and were wintered at a cost of \$23.28. During the summers of 1915 and 1916 the cows were pastured an average of 210 days. Those in lot 1 gained 67.11 lbs. each per summer, and those in lot 2, 73.31 lbs. The average weight of calves supported per cow on pasture was 249.31 lbs. for lot 1 and 360.53 lbs. for lot 2. The total annual cost of maintenance per cow was \$42.31 for lot 1 and \$43.04 for lot 2. The annual feed cost for a pure-bred herd bull was \$63.63.

It is stated that during the five and a half years of the experiment the selection of breeding animals on the basis of growth of calves, regularity of breeding, milking tendencies, appetites, feed capacity, and other utility characteristics and the use of a pure-bred sire resulted in marked improvement. Both lots have produced 100 per cent of calves during the last two years. The Shorthorn calves were 2.05 lbs. heavier at birth than the Aberdeen Angus calves, and spring calves averaged about 10 lbs. heavier than fall calves. In both lots male calves were slightly heavier than female calves. The calves at weaning time (9 months) averaged 532.46 lbs. in weight for lot 1 and 504.81 lbs. for lot 2. On the basis of 100 per cent calves raised the cost per calf at weaning was \$43.75 for lot 1 and \$45.40 for lot 2.

A lot of 23 weaned growing heifers made an average daily gain of 1.221 lbs. per head during the winter on corn silage and 3 lbs. of cottonseed meal per 1,000 lbs. of live weight. On the same ration the winter gains of a lot of 18 bred heifers averaged 1.079 lbs. per head. On pasture 12 growing heifers gained a daily average of 0.502 lb. per head during the summer period, while 3 bred heifers lost 0.161 lb. per head daily. The annual cost of keeping the growing heifers was \$21.09, and of the bred heifers \$30.59. On the above rations heifers made satisfactory development and growth in winter quarters and produced normal calves. The cost of raising heifers to 30 months of age was \$81.61 for calves born September 1, and \$90.99 for calves born March 1.

In fattening tests it was found that calves weighing less than 550 lbs. are not so profitable as heavier calves because of the longer period of time required to put them into the desired market condition. On the whole the investigations show that calves dropped in the fall of the year and fattened after weaning at 6 months of age, while on pasture and during the early winter, are more profitable than spring calves raised and fattened as baby heeves during the following winter.

Wintering mature brood sows, W. P. SNYDER (*Nebraska Sta. Bul. 162* (1917), pp. 3-29, fig. 1).—During seven winters 20 or more brood sows that had produced at least one litter were wintered on alfalfa or a mixture of alfalfa and corn. The alfalfa was fed as hay, as chopped hay, and as chopped hay stewed or boiled in water.

From the trials the conclusion is reached that old sows may be cheaply wintered on alfalfa hay alone, provided it is of good quality. More satisfactory results, however, are probable when some grain in addition is fed. A ration of alfalfa hay in the rack and 1 per cent of the weight of the sows in shelled corn in the trough proved satisfactory and reasonably low in cost. On this ration sows were wintered at a cost of \$5.29 each, while on a ration of chopped alfalfa hay and ground grain, 1:1, the cost was \$6.92. The use of self-feeders and a ration of chopped alfalfa and chopped corn, 3:1, was also satisfactory.

Alfalfa silage did not appear to be a suitable feed for hogs, nor was there any advantage derived from stewed alfalfa compared with alfalfa hay. When the price of alfalfa approaches that of corn the compelling of its consumption in large amounts is deemed of doubtful value.

Pork production in Nebraska, E. A. BURNETT (*Nebraska Sta. Circ. 4* (1917), p. 7).—Suggestions are given for the production of pork under present conditions, emphasis being placed upon the utilization of pasture and by-products to supplement high-priced grain.

Stallion enrollment.—VII. Report of stallion enrollment work for the year 1917 with lists of stallions and jacks enrolled, H. E. McCARTNEY (*Indiana Sta. Circ. 73* (1918), pp. 120).—There were enrolled during the year 3,451 stallions and jacks. This is a decrease of 470 as compared with the previous year and represents the elimination largely of grades and scrubs. The number of mares bred was much smaller than in the previous year, apparently because of a greater proportionate increase in the values of cattle and hogs.

Licensed stallions in Utah during the season of 1917, W. E. CARROLL (*Utah Sta. Circ. 27* (1917), pp. 3-29).—The distribution of licensed stallions by breeds and counties, the number of licensed animals in each county, and the distribution of the breeds of stallions in the State are shown in tables. Of the 400 animals licensed during the year there were 248 of the draft breeds, 34 of the light breeds, 1 jack, and 117 grades.

**American jack stock and mule production**, W. S. ANDERSON and J. J. HOOPES (*Kentucky Sta. Bul. 212 (1917)*, pp. 285-304, figs. 28).—This is a contribution to the history of jack breeding in the United States. The influence that certain great sires have had upon the upbuilding of the American jack breed of domestic asses is pointed out, and tabulated pedigrees are given of a number of noted jacks. A plea is made for the standardization in size and type of jack stock, and suggestions are given for the breeding, selection, care, and judging of jacks and jennets, including a classification of jacks and jennets for fairs and a score card for jacks. A few common diseases of jacks are noted, with directions for their control. Notes on mule production, the future demand for mules, and the characteristics of brood mares for mule production are included.

**The chemical composition of green sprouted oats**, J. M. BARTLETT (*Maine Sta. Bul. 266 (1917)*, pp. 285-290).—Methods used by the station in sprouting oats for poultry feeding are outlined. Analyses of sprouted oats were made at different stages of growth, and the nutritive value of sprouted oats was compared with unsprouted oats.

The results show that the sprouted oats at the proper stage to feed (from 3 to 4 in. high) contain about 77 per cent water, 28 per cent protein, 8 per cent crude fiber, 1.3 per cent fat, and 16 per cent nitrogen free extract. There is an actual loss of dry matter in sprouting oats, consequently the only advantage of the process is the production of succulent green feed when grass and other green feeds are not available.

**Hens should observe all wheatless days** (*Mo. Bul. Ohio Sta. 3 (1918)*, No. 3, p. 96).—Of 50 pullets fed 24 weeks a ration of wheat supplemented with a small amount of bran, meat scrap, and linseed meal, 21 died. Only 1 pullet died within the next 28 weeks, when corn was fed instead of wheat in the mixture. Only 2 hens died in the year in the lot fed mainly corn with no wheat. Egg production decreased as the proportionate quantity of wheat fed in rations to four lots increased. Hens fed corn, with a small quantity of bran, meat scrap, and linseed meal, laid 58 per cent more eggs than hens fed a similar ration except that wheat replaced corn. The addition of wheat in the mixture fed in this experiment decreased the amount and increased the cost of egg production.

**Pigmentation and other criteria for the selection of laying hens**, A. F. BLAKESLEE, J. A. HARRIS, D. E. WARNER, and W. F. KIRKPATRICK (*Connecticut Storrs Sta. Bul. 92 (1917)*, pp. 93-104, figs. 23).—The data upon which this study is based were drawn from the egg-laying contests conducted for the past five years at the Storrs Station. A biometric analysis of the correlation between ear lobe pigmentation and egg production in White Leghorn hens is made of data already noted (E. S. R., 38, p. 276). An analysis was also made of the relation of laying to pigment changes in beak, vent, legs, and comb and to condition of feathers due to molting. The breeds used as the basis of this analysis were Leghorns, Plymouth Rocks, Wyandottes, and Rhode Island Reds.

It was found that as a bird commences to lay the yellow color disappears from the ear lobes (in the Leghorns), the vent, the beak, and the legs, apparently in the order named. The legs are the last of the parts mentioned to lose yellow pigment after laying begins, and are the last to regain the yellow when laying ceases. The grade of color in the ear lobes, vent, and beak are indicators of the laying activity in the relatively immediate past, while the legs are indicative of laying activity in the more distant past. The greater the amount of yellow, the less active has been the laying.

Records taken in July, September, and October indicate that October, at the end of the pullet year, is in general the best time in which to use the color test in selecting superior layers. In October the value of the comb and the condition

of the feathers as regards molting was also tested as possible criteria for laying. Birds with large bright combs have been better layers than those with dull, shriveled combs. Birds that have not molted till late have been better layers than those that molted earlier.

Of all the characters graded for yellow pigment, the vent averaged the best criterion in October for selecting the high producers, while the legs averaged the best for picking out the low producers. Of all the characters studied, the condition of feathers in relation to molting averaged the best for selecting high producers. The hens were also selected on the basis of condition of feathers in combination with the best pigment test. In all cases the group of birds with pale vents that had failed to molt when the records were taken had a distinctly higher yearly average egg production than that given by any single criterion. This combination was also the best in all cases for picking out the low producers.

The bulletin closes with a discussion, the essential points of which have already been noted (E. S. R., 33, p. 172), of the basis upon which poultry shows are conducted, with suggestions of ways in which the ideals of the fancier may be changed to meet those of the utility breeder.

**Conserving the baby chicks.** W. C. THOMPSON (*New Jersey Sta. Hints to Poultrymen*, 6 (1918), No. 6, pp. 4).—Brief notes are given on the selection and care of eggs for incubation, the care of chicks in the incubator and brooder, and the feeding of baby chicks.

**War chicks.** Mrs. G. R. SHOUR (Washington Sta., West. Wash. Sta. Mo. Bul., 1 (1918), No. 12, pp. 183-188).—Combinations of grains and mashes are given, together with detailed directions for feeding and managing chicks in brooders on a wheatless diet.

#### DAIRY FARMING—DAIRYING.

**The effects of high protein and high energy rations in feeding dairy cows.**—I. Effects on the utilization of the rations, W. B. ELLETT and C. W. HOLDAY (Virginia Sta. Tech. Bul. 12 (1917), pp. 29-45; Rpts. 1915-16, pp. 39-45).—Feeding and digestion experiments are reported involving two lots of two Holstein cows each, weighing from 1,000 to 1,050 lbs. One lot was fed a high energy ration with a nutritive ratio of 1:11 and consisting of 9 lbs. of corn meal, 2 lbs. of bran, and 40 lbs. of silage. The other lot was fed a high protein ration with a nutritive ratio of 1:24 and consisting of 2 lbs. of cottonseed meal, 2 lbs. of bran, 7 lbs. of gluten meal, and 40 lbs. of silage. The experiment was started in 1913, and since September, 1915, the cows have been fed the above rations continuously. Tabulated data show the composition of the different feeds used and the amount of feeds and food constituents actually fed. From these it is seen that the high energy ration supplied an excess of energy and barely enough protein and the high protein ration an excess of protein and barely enough energy to meet the needs of the cows as calculated from average digestion factors.

A 10-day digestion trial was conducted with one cow of each lot, beginning April 24, 1916. On this date the high energy cow was at her minimum weight, 890 lbs., and the high protein cow weighed 1,057 lbs. From tabulated results of this digestion trial it is concluded that "the cow fed the high energy ration consumed almost all of her food and in so doing obtained a large surplus of energy. Her ability to digest the nutrients decreased until the energy dropped to the requirements of her body for maintenance and milk production. Then this decrease in digestibility stopped. The digestibility of the protein decreased 47 per cent, hence the cow was unable to maintain her flesh and decreased in

weight rapidly. The reduction in digestibility affected the fiber more than any other nonnitrogenous nutrient. The reduction for fiber was 54 per cent, for nitrogen-free extract 24 per cent, and for fat 19 per cent. . . .

"The high-protein cow refused 25 per cent of her ration, but the amount consumed supplied her with sufficient energy and two and one-half times as much protein as was necessary, and this excess protein was digested. The digestibility of the nutrients agreed closely with the average coefficients. These results show that a cow disposes of an excess amount of digestible protein by digesting it and voiding the excess nitrogen in her urine. When surplus energy is contained in the nutrients consumed the digestibility of the ration is lowered until the net energy is balanced to the needs of the animal. The maintenance requirement of the high energy cow for protein is shown to be at least 0.31 lb. daily. . . .

"The long-continued diminution in weight due to lack of protein on one hand and the gaining in weight due to excess of protein on the other hand indicate a considerable difference in the amounts of nitrogenous material that can be stored up in the mature ruminant's body. The high protein ration seemed to favor the production of a large quantity of milk fat from substances other than food fat. The food fat exactly balanced the milk and feces fat with the cow fed the high energy ration."

These results emphasize the importance of determining the effects of dissimilar rations in feeding experiments. It is indicated that, due to differences in digestibility of nutrients, both high protein and high energy rations give results that introduce inaccuracies in feeding investigations in almost every phase of the work.

Experiments with calf meals, O. F. HUNZIKER (*Indiana Sta. Rpt. 1917*, pp. 27, 28).—In testing calf meals as substitutes for milk for dairy calves five mixtures were fed for a period of 180 days to 25 calves divided into five lots of 5 calves each. The meals were fed in connection with milk, alfalfa hay, and a dry mash of ground corn and oats. The meal mixtures were as follows: Lot 1, the same as that fed lot 2 in a previous experiment (E. S. R., '20 p. 565); lot 2, soy bean meal, cottonseed meal, wheat middlings, and linseed meal, equal parts by weight; lot 3, blood flour, hominy feed, and wheat bran equal parts by weight; lot 4, black albumin, wheat middlings, soy bean meal and linseed meal (2:4:5:5); and lot 5, the same as No. 1 except that skim milk replaced whole milk. The protein content of these meals was 33.32, 28.73, 33.97, 31.44, and 33.59 per cent, respectively.

It required 3.63 lbs. of whole milk per head daily, in addition to ration No. 1, to produce a gain of 1 lb. per day. Ration No. 2 (vegetable protein) required 2.71 lbs. of whole milk in addition to the meal to yield a body gain of 0.73 lb. daily, while ration No. 3 (animal protein) yielded a body gain of 0.8 lb. daily through the use of 1.54 lbs. of milk in addition to the calf meal fed. Ration No. 4 produced a fair gain in body weight but required an excess of whole milk, due to the extreme laxativeness of certain ingredients in the meal. Ration No. 5 produced a daily gain of 0.91 lb. and required but 0.5 lb. of whole milk in connection with 3.25 lbs. of skim milk.

Dairy calves for veal, G. H. TRUE and C. V. CASTLE (*California Sta. Cir. 196 (1918)*, pp. 7).—Notes are given on market classification for veal calves and factors determining whether it is profitable to feed dairy calves for veal, together with an outline of feeding practices.

The number of bacteria in milk, J. D. BREW and W. D. DOTTERBEE (*New York State Sta. Bul. 439 (1917)*, pp. 479-522).—In continuation of earlier work (E. S. R., '31, p. 78) a report is given on 643 cooperative counts made by both

he plate and microscopic methods with fresh, unpasteurized market milk from the Geneva city milk supply. The microscopic counts were made in two ways, namely, counts of individual bacteria and counts of "groups" of bacteria.

Of the 643 comparative counts, 175 were higher by the plate count than by the individual count and 123 were lower by the plate count than by the group count. In 345 samples the plate counts were higher than the group counts and lower than the individual counts. All but 32 of the instances in which the plate counts were higher than the individual counts occurred in samples of less than 30,000 bacteria per cubic centimeter. The next class of 123 samples was evenly distributed throughout the series of counts, and the discrepancies are thought to be due either to the presence of living bacteria which did not grow on agar or to the presence of dead bacteria in a stainable condition. However, large numbers of dead bacteria in unpasteurized milk are the exception rather than the rule. If the 200 counts made of samples containing less than 30,000 bacteria per cubic centimeter are excluded, the plate counts are intermediate between the two microscopic counts in 71 per cent of the remaining 443 counts.

It is noted that the plate count probably represents fairly well the number of groups of bacteria in the milk after they are broken apart in the dilution waters; the group count, the number of groups of bacteria originally present in the milk; and the individual count, the number of bacteria actually present. A study was therefore made of the variation in size and compactness of the groups of bacteria originally present in milks of different grades. In general, the groups of bacteria were found to be of small average size in milk containing very few bacteria, and to increase in size as the number of bacteria increases, reaching an average size of from 12 to 14 individuals in milk containing about 1,000,000 bacteria per cubic centimeter, and diminishing in size as the number of bacteria becomes greater than this. Data obtained indirectly indicate that the average clump of bacteria in market milk breaks apart 2.6 times in preparing dilution samples. In 24 instances out of 345 the clumps broke into seven or more groups each, and in one instance the resulting number of groups was 16.5 times the original number. "The actual number of bacteria in milk is usually greatly in excess of the figure obtained by the plating method."

How bacteria in milk are counted, F. H. HALL (*New York State Sta. Bul. 439, popular ed. (1917)*, pp. 11, figs. 2).—A popular edition of the above.

What is meant by "quality" in milk, R. S. BREED, H. A. HARDING, W. A. STOCKING, JR., and E. G. HASTINGS (*New York State Sta. Bul. 438 (1917)*, pp. 459-475).—This report was also issued as Illinois Station Circular 205, from which it has been noted (E. S. R., 38, p. 479).

Composite v. one-day sampling of milk for the Babcock test, W. H. EATON (*North Carolina Sta. Bul. 240 (1918)*, pp. 3-8, figs. 2).—In order to determine the accuracy possible in estimating the milk fat production of cows from samples taken from one day's milking during each month a test was made with 12 cows during a period of 90 days. At the end of each month of the experiment the milk fat production was estimated for each cow by the one-day-per-month method and by the composite method of sampling. By the composite method samples were taken from each milking of all the cows on test, and the fat yield calculated from weekly tests of these composite samples.

It was found that the three months' yield of the 12 cows as estimated by the one-day-per-month method was 786.36 lbs. of fat, and by the composite-sample method, 717.51 lbs., or a difference in fat production of 1.91 lbs. per cow per month.

Keeping qualities of butter.—IV, Cream ripening and its influence.—Bacteria in cream, their numbers and types and their itinerary in the manufacture of butter, C. W. Brown and K. PEISER (*Michigan Sta. Tech. Bul. 29 (1916)*, pp. 7-20, figs. 3).—This number of the series of contributions on the keeping qualities of butter (E. S. R., 22, p. 482) deals with the bacteria in cream relative to the numerical count and prevailing types, and traces these types through the different steps in the manufacture of butter. The cream used in the study was obtained from dairymen in the vicinity of the station. It contained about 30 per cent fat and averaged 0.43 per cent acidity. The acidity of the ripened cream averaged about 0.5 per cent. The acidity of the butter was about 0.2 per cent, and remained practically constant from time of drawing the buttermilk to 30 days later.

The microorganisms in the butter were for the most part those that were in the cream. Neither the buttermilk nor the freshly churned butter contained per unit volume as many living bacteria as the ripened cream. An average of about 30 per cent of the bacteria living in ripened cream failed to grow after the mechanical agitation in the churn. The process of washing and salting removed about 50 per cent of the microorganisms from the unsalted butter. Positive tests for peroxidase and reductase were obtained in the cream and in the butter, but not in the starter, in the ripened cream, or in the buttermilk. The negative results are thought to be due to a temporary inactivation by high acidity.

*Bacterium lactis acidii* predominated throughout the manufacture of butter. Other organisms appearing frequently were *Micrococcus lactis varians*, *M. lactis aureus*, *M. lactis albidus*, *Streptococcus lactis fulvus*, *Bacterium lactis album*, *Bacillus coli*, *torule* (liquefying and nonliquefying), and *Oospora lactis*.

The more important literature is reviewed and listed.

Keeping qualities of butter.—V, Pasteurization and its influence.—A study of the factors which influence the resistance of lactic acid bacteria to heat, C. W. BROWN and K. PEISER (*Michigan Sta. Tech. Bul. 30 (1916)*, pp. 7-18).—A continuation of the work noted above. The work here reported, a preliminary account of which has been noted (E. S. R., 33, p. 675), was undertaken to ascertain whether lactic acid bacteria in milk and cream survive pasteurization at a temperature commonly considered as efficient, and whether such survival is due to an inherent property of the organism or due to some external protection exerted by the constituents of the milk.

The temperature of the cream during pasteurization by the holding process in the pasteurizer (with coil rotating) used in these experiments was found to be almost constant throughout the whole mass. The thermal death point of some of the nonspore-bearing bacteria isolated from pasteurized milk and cream was higher than the pasteurization temperature (145° F., held for 20 minutes), while many had a thermal death point below the temperature of pasteurization. The thermal death point of a culture of *Bacterium lactis acidii* and of a culture of *Bacillus coli* was compared in bouillon and in four divisions of a sample of sterile milk. It was found that whey raised the thermal death point from 2 to 4° C., separated milk from 4 to 6°, whole milk about 8°, and cream from 12 to 14°. The addition of small amounts of lactic acid to a milk suspension of bacteria did not change their thermal death point.

Some of the factors affecting the heat resistance of bacteria in milk are discussed.

The more important literature is briefly reviewed and listed.

Protein hydrolysis in fresh and stored butter made from raw and pasteurized cream, O. F. HUNZIKER (*Indiana Sta. Rpt. 1917*, pp. 35, 36).—In additional experiments upon the protein hydrolysis in butter during storage (E. S.

(*l.*, 36, p. 772) nine lots of butter churned from three separate gatherings of cream were used. The butter was made from unpasteurized cream, from cream pasteurized at 145° F. held for 20 minutes, and from cream pasteurized at 180° flash. The butter was analyzed when fresh and after 60 days storage at from 6 to 15°. The precipitants used were bromin, copper sulphate, and phosphotungstic acid. The nitrogen not precipitated by the phosphotungstic acid was also determined by the Van Slyke method for determining the aliphatic amino-acid groups.

Phosphotungstic acid gave the most uniform and concordant results. It was found that the change both in the Van Slyke amino nitrogen and nitrogen not precipitated by phosphotungstic acid was greatest in raw cream butter and considerably less in pasteurized cream butter.

#### VETERINARY MEDICINE.

Chemical pathology, H. G. WELLS (*Philadelphia and London: W. B. Saunders Co., 1918, 3. ed., rev. and ent., pp. 707*).—In the revision of this book for the third edition (E. S. R., 32, p. 78) several subjects have been rewritten, especially gout, specificity of immunological reactions, anaphylaxis, icterus, acidosis, diabetes, and uremia. New sections have been added on the Abderhalden reaction, specificity, chemical bases of growth, atrophy, and the pressor bases. R. T. Woodyatt has revised the chapter on diabetes, contributed by him to the second edition to include the recent contributions to carbohydrate metabolism obtained through his new method for accurately timed and measured intravenous injections.

Immunity and anaphylaxis, J. DANYSZ (*Jour. Infect. Diseases*, 22 (1918), 2, 5, pp. 427-456).—This is a theoretical discussion of the subject, with an explanation of the nature and mechanism of the reactions which determine the different phases of the evolution of infectious diseases and pathological conditions caused by animal or vegetable proteins considered as normally toxic, or synthetic colloids such as arsenobenzene, and by proteins considered as nutritive on absorption after complete gastrointestinal digestion but which use a state of anaphylaxis when absorbed by hypodermic, intravenous, or even intrarectal injections.

The author concludes that the pathological condition in infectious diseases is due to anaphylaxis which is an intracellular or intravascular indigestion, or combination of both. Indigestion is the inability of the organism to rapidly transform colloidal antigens into crystalloids. If it is intravascular, the effect is immediate and rapid (anaphylactic shock). If intracellular, the disturbances and lesions which result are more or less slow in appearing and may continue for hours, days, or years (as in tuberculosis, leprosy, and syphilis) chronic anaphylaxis.

A contribution to the theory of anaphylactic shock, J. L. KRITCHWISKY (*Jour. Infect. Diseases*, 22 (1918), No. 2, pp. 101-114, pl. 1).—“The sap of a plant, *Cotyledon-scheideckeri*, which is able to precipitate animal serum and to agglutinate and cause lysis of red blood corpuscles, has the power to provoke the symptoms and the anatomic changes characteristic for anaphylactic shock when introduced into the veins of animals. The injection of the Cotyledon fluid under the skin of animals provokes phenomena identical with the local anaphylaxis, known as Arthus’ phenomenon. When deprived of all precipitating and agglutinating substances, the fluid is quite harmless for animals. The shock and the death after injection of the Cotyledon fluid are due to change in the degree of the disperseness of the plasma colloids.

"In anaphylactic shock in immunized animals immune bodies cause the same change in the degree of disperseness in vitro substances in the Cotyledon juice which I examined; it is, therefore, quite natural to suppose that the shock observed in anaphylaxis and related processes just as the shock studied in the present investigations is due to change in the degree of disperseness of the plasma colloids of the blood. On this account one may regard all these processes—and others, showing analogous, clinical, and anatomic changes—as modified processes caused by a change of degree of disperseness of the blood plasma."

The rôle of specific fats in complement fixation, C. C. WARDEN (*Jour. Infect. Diseases*, 22 (1918), No. 2, pp. 133-141).—"The value of antigens in serum tests for the presence of antibody in gonorrhœa, syphilis, typhoid fever, and cholera appears to depend on fatty complexes of definite chemical arrangement or configuration which represent the fatty content of the several micro-organisms causing those diseases. The reactions of the test are surface reactions and depend on the physical state of the antigen. The serum test as applied to tuberculosis is fallacious and unreliable, probably because of the absence of sensitizers in the serums."

Antiseptics, T. RENNIE (*Jour. Soc. Chem. Indus.*, 37 (1918), No. 2, pp. 23 T. 26 T; *Sci. Amer. Sup.*, 85 (1918), No. 2294, pp. 202, 203; *abs. in Chem. Abs.*, 1 (1918), No. 10, p. 1092).—"This article reports the results of a study by the author, in cooperation with A. M. Drennan and W. Campbell, of the efficacy of the common antiseptics in use at the time of the investigation at the military hospitals in Edinburgh and describes the preparation and method of application of "Eupad" and "Eusol." The former is a powder consisting of equal weights of chlorid of lime and boric acid. Eusol is prepared by shaking up 25 gm. of Eupad in a liter of water and filtering off the sediment. In Eusol it is claimed that "the full value of hypochlorous acid is available without the drawbacks inherent in the earlier solutions containing this potent reagent."

The disinfecting power of periodol, G. SAMPIETRO (*Ann. Ig.* [Rome], 2 (1917), No. 4, pp. 236-246; *abs. in Abs. Bact.*, 1 (1917), No. 6, pp. 542, 543).—"Researches are reported on the sterilizing power of periodol, a new disinfecting agent composed principally of iodin and chlorin. It decomposes rapidly in water, liberating oxygen, chlorin, and iodin. Tests with organisms most likely to contaminate drinking water, such as cholera vibrio, *B. typhosus*, *B. dysenteriae*, *B. diphtheriae*, *Staphylococcus pyogenes aureus*, and *Streptococcus pyogenes*, show that at a dilution of 1:50,000 a fresh solution of the periodol has very effective disinfecting action. At this concentration it does not produce any changes in taste or odor and is harmless to the human organism. It may also be used as a disinfectant for the oral and nasal cavities at a dilution of 1:1,000.

Brilliant green as a bactericidal agent for the purification of vaccine virus, C. KNUMMEL, JR., F. S. FIELOER, and T. A. WATSON (*Jour. Infect. Diseases*, 22 (1918), No. 2, pp. 118-124, fig. 1).—"Brilliant green in a concentration of 1:10,000 has no appreciable effect on the potency of vaccine virus. This amount of dye when used in combination with the glycerol-carbolic solution usually employed markedly hastens the rate of reduction of the bacterial content, rendering most preparations bacteriologically sterile in from two to four weeks.

"Although the dye can not be relied on to kill tetanus spores, should they be present no difficulty should be encountered in demonstrating their presence after the associated bacteria are destroyed. The results obtained warrant its practical application to vaccine virus for general distribution, or at least in emergencies when the virus must be employed shortly after collection from the calf. The use of brilliant green gives a simple method hitherto not available for obtaining a bacteriologically sterile but fully potent virus for experimental purposes."

Report of the veterinary department, R. A. CRAIG (*Indiana Sta. Rpt. 1917*, p. 61-67).—The agglutination test for infectious abortion of cattle was made on 226 blood samples and 46 milk samples. Where the milk and blood samples from the same animal were compared, the blood showed a higher percentage of reactions to the agglutination test.

In post-mortem findings of hemorrhagic septicemia of cattle, the most prominent lesion was a hemorrhagic inflammation of the anterior air passages, indicating that dust may be a carrier of the infection. The use of hemorrhagic septicemia bacterin in a herd in which four cases with two deaths from the disease had occurred apparently checked the disease.

Experimental work with hog cholera has been noted from another source (E. S. R., 38, p. 688).

Annual report of director of veterinary research, 1915-16, A. THIENEE (*Union So. Africana Dept. Agr. Rpt. 1916*, pp. 45-49).—This, the usual annual report, relates to research work carried on during 1915-16 (E. S. R., 35, p. 678).

Experiments are reported in which bots that were taken from the stomach of a horse dead of pernicious anemia produced the disease when emulsified and injected into a susceptible horse. Bots from a healthy horse did not produce the disease, thus disproving the claim of the Seyderhelius that pernicious anemia is produced through this agency (E. S. R., 35, p. 80).

The spinose ear tick (*Ornithodoros megnini*), first found to occur in South Africa in 1912, is reported to be responsible for a considerable amount of injury to sheep, goats, and calves.

Annual report of the imperial bacteriologist for the year ending March 31, 1917, A. L. SHEATHER (*Ann. Rpt. Imperial Bact. [India]*, 1917, pp. 25).—This is the usual annual report in which data are given on the preparation and use of serums and vaccines for rinderpest, anthrax, hemorrhagic septicemia, etc.

The treatment of epizootic lymphangitis (*Vet. Rev.*, 2 (1918), No. 1, pp. 16-28).—A review of recent literature.

The detection of Johne's disease by the use of "johnin," E. G. HASTINGS, S. A. BEACH, and F. B. HADLEY (*Jour. Amer. Vet. Med. Assoc.*, 52 (1918), No. 4, pp. 482-486).—The authors report upon tests made of 43 animals of which 5 reacted and upon slaughter showed the lesions characteristic of Johne's disease. Four of the five showed marked temperature reactions to the intravenous injection of 10 cc. of johnin, while the physical condition of the fifth gave evidence that it was affected.

The prophylaxis of Malta fever by the active immunization of animal carriers of the organism, H. VINCENT (*Compt. Rend. Acad. Sci. [Paris]*, 186 (1918), No. 8, pp. 359-362).—Inoculation experiments are reported verifying the degree of immunity conferred on goats by the method of vaccination previously noted (E. S. R., 25, p. 386). The results show that vaccination produces a strong immunity which protects the animals against a large dose of living virus introduced under the skin, into the veins, or by way of the digestive tract.

Antirinderpest vaccinations by the simultaneous method of serum and of virulent blood from the point of view of their influence on malaria, J.-B. Pier (*Bul. Union Agr. Egypte*, 15 (1917), No. 121, pp. 93-98).—Cases are reported which tend to prove that the hematozoal diseases of the blood of cattle are not transmitted following injections of blood employed as preventive inoculations against rinderpest. The experiences of the author in the immunization against rinderpest of 854 animals show that only 2 calves died of possible complications due to the vaccination and that only 2 cows succumbed to plasmodiosis. The fact that a large number of animals vaccinated five years before have been in intimate and permanent contact with animals having

rinderpest without receiving the disease indicates that the immunity continues for at least five years after vaccination.

**A new method of staining the tubercle bacillus, C. CÉPÈDE** (*Compt. Rend. Acad. Sci. [Paris]*, 166 (1918), No. 8, pp. 357-359).—The method depends upon the differentiation of the alcohol-acid resisting Koch bacillus from other organisms which are not alcohol-acid resistant by the use of a counter stain with which the decolorized organic acid and alcohol have been combined. The counter stain, "methylene lactobue or Cépède blue," is prepared by placing an excess of powdered methylene blue in a flask containing 40 cc. of lactic acid, 160 cc. of water, and 800 cc. of 95 per cent alcohol. Smears are prepared, fixed by heat, and stained with carbol-fuchsin in the usual way. They are then placed with or without washing in the lactobue solution for two or three minutes, washed in water, and dried.

The advantages of this method of staining are said to be the precision and sharpness of coloration of the Koch bacillus, associated flora, and histological elements; a very appreciable economy of time; and accuracy of diagnosis. By means of it the organism may be detected in feces, urine, blood, and sputum.

**Observations on complement fixation in tuberculosis, W. MEYER** (*Med. Rec. [N. Y.]*, 93 (1918), No. 5, pp. 193, 194).—Cases with tuberculous glands or bones showed a higher percentage in 4+ human type than pulmonary cases; this holds good also in bovine type, namely 2+ or simply 1+. The third stage cases (pulmonary type) that showed + were all early third-stage cases; all late third-stage cases were negative. Some cases were + one month and negative the next month or vice versa; these cases were all anemic, had lost weight, and complained of fatigue, but showed no signs of disease by X ray or other diagnostic methods. The leucitic condition nowhere interfered with the tuberculosis deviation test, since those that reacted to both tests showed unmistakable signs of active tuberculosis.

"The biologically treated cases became negative in 82 per cent. A case showing 4+ human and 2+ bovine having been treated with a mixture of human and bovine tuberculin for three or four months, for instance, would under a new test show human + and bovine ± and be negative a few months later. Out of 89 pulmonary cases, 5 increased the + by one or two and the bovine, originally —, became + in one case after three months' treatment, but became — again under continued treatment; all other cases showed a continuous decrease in the + reaction."

**The presence of a growth-producing substance in cultures of typhoid bacilli, A. J. P. PACINI and DOROTHY W. RUSSELL** (*Jour. Biol. Chem.*, 54 (1918), No. 1, pp. 48-49, figs. 4).—Growth experiments on rats are reported proving that "the typhoid bacillus, in growing, produces vitamin which can be isolated and identified by proper biological methods. The bearing on the effect of the same upon the general metabolism of typhoid patients, and indications of a scientific basis for new methods of feeding these cases, are under investigation."

**Standardization of antityphoid vaccine, G. W. MCCORMICK** (*Amer. Jour. Pub. Health*, 8 (1918), No. 4, pp. 299-301).—The technique employed at the Hygienic Laboratory, Washington, D. C., consists in inoculating rabbits with the vaccine in single doses of 2,500,000,000 organisms or in three doses at intervals of 24 hours, bleeding the animals after eight days, and testing the serum for agglutinating power with living Rawling culture suspended in physiological salt solution. The serum is used in varying dilutions of from 1:25 to 1:1,600 and is mixed with an equal volume of the suspension of the organism, shaken, and kept at 37° C. for an hour. A control test is made with a known satisfactory vaccine.

**Abortion disease in cattle.** L. VAN ES (*North Dakota Sta. Circ. 18* (1918), p. 19).—This is a review of the present status of knowledge of the disease and means for its control.

**A study of the presence of *Bacterium abortus* (Bang) in milk.** L. H. COLEMAN (*Michigan Sta. Tech. Bul. 33* (1916), pp. 5-37, figs. 2).—This publication includes a brief review of the history of bovine infectious abortion and results of investigations conducted by the author along the following lines: 1) Methods of studying the presence of *B. abortus* in milk; (2) a study of its effect upon man; and (3) facts disclosed by a study of its presence in milk by means of the agglutination test (E. S. R., 38, p. 286).

The agglutination and complement fixation tests were employed, using milk and milk serum instead of blood serum and following a modification of the technique of Surface (E. S. R., 27, p. 531). Results of this part of the investigation show that there is apparently no connection between the *B. abortus* antibody content of the blood and of milk. The antibody content of the milk may vary from quarter to quarter of the udder, showing that the antibodies present are due to local infection and do not come from the blood stream. As high or a higher antibody and cellular content in the strippings than in the fore milk seems to indicate active infection and the presence of *B. abortus* in the milk in sufficient numbers to produce the typical lesions and blood reactions on inoculation in guinea pigs. A lower antibody and cellular content in the strippings seems to indicate that infection is slight and that the organism is not present in sufficient numbers to cause infection. The agglutination reaction appears to be more reliable than the complement-fixation test. A pure culture of *B. abortus* introduced into the milk cistern of a cow's udder causes the appearance of agglutinins in the milk. The presence of the organism has always been found to be accompanied by the agglutinins for the organisms, but the presence of agglutinins does not always signify the presence of the organism itself. Agglutinins may be present in the milk of cows that have never calved and those that have never aborted.

In the second part of the investigations reported an examination was made of the sera of a number of persons drinking raw milk, pasteurized milk, and no milk by the complement fixation and agglutination tests, using *B. abortus* as antigen. To determine whether or not *B. abortus* antibodies could be made to appear in the sera of adults by injection of infected milk, a feeding experiment is conducted in which the milk used had a high *B. abortus* antibody content. The use of this infected milk caused antibodies to appear in the blood serum, apparently indicating a passive immunity due to the absorption in the intestine of the antibodies present in the milk. There was no proof that *B. abortus* is throgenic for human beings.

A bibliography of 33 titles is appended.

**The transmission of *Bacterium abortus* (Bang) to newborn calves through the ingestion of milk.** I. F. HURDLESON (*Michigan Sta. Tech. Bul. 32* (1916), pp. 5-22).—The possibility of the transmission of *B. abortus* to calves through the ingestion of milk was studied by feeding newborn calves with "naturally infected milk," that is, milk reacting positively to the agglutination test using *B. abortus* as antigen, and with "noninfected milk." The results of the feeding experiments were studied by means of the agglutination and complement fixation tests upon the blood sera of the calves using *B. abortus* as antigen. The calves were bled from the jugular vein at intervals of about a week and the blood sera tested. Observations and microscopical examinations for matting and staining of the sexual hairs of the calves were made during the course of the feeding.

Eight calves were fed upon naturally infected milk, six upon noninfected milk, a control was fed pasteurized naturally infected milk, and a second control was fed noninfected milk plus 5 cc. of a 48-hour bouillon culture of *B. abortus* in order to compare the result from feeding naturally infected milk with that of artificially infected milk. Tables are given showing the history of the dams of the calves used in the experiments and the results of the various feeding experiments. These results show that "agglutinating and complement fixing bodies for *B. abortus* are very rarely demonstrated in the blood of calves as a result of ingesting naturally infected milk. Calves may give a positive reaction to the complement fixation test immediately after birth. The reaction probably signifies a prenatal infection. There is favorable evidence that antibodies circulating in the body of the mother are not transmitted to the fetus in utero.

"The data strongly emphasize the necessity of testing the blood of calves at birth in order to differentiate between positive reactions that may be due to the ingestion of milk and positive reactions that may be present at birth. There appears to be no connection whatever between the feeding of milk and the matting and staining of the sexual hairs of newborn calves."

The relation of streptococci to bovine mastitis and septic sore throat, D. J. DAVIS (*Amer. Jour. Pub. Health*, 8 (1918), No. 1, pp. 40-46).—This is a brief summary of information on the subject.

The author has failed to find any evidence that strains of streptococci pathogenic to man can resist the usual temperature for pasteurization, namely, 145° F. for 30 minutes. In tests made by him of 98 strains of streptococci none of 24 pathogenic hemolytic streptococci of human origin resisted 140° for 30 minutes. Twenty of 74 strains of hemolytic streptococci of milk origin and having practically no virulence resisted 155° for 30 minutes.

Piroplasmosis of cattle in Panama, H. C. CLARK (*Jour. Infect. Diseases*, 22 (1918), No. 2, pp. 159-168).—The data here presented have been summarized by the author as follows:

"Piroplasmosis of cattle is present and practically speaking universal in Panama. Nonimmune cattle when imported into Panama contract the disease and many of them die. A positive ante mortem diagnosis of piroplasmosis in this locality is extremely difficult on account of the scarcity of the parasite in the peripheral blood. The examination of the blood in films of the gray matter of the brain makes the detection of the parasite at necropsy and in the abattoir comparatively easy. In Panama piroplasmosis has been found in the horse, cattle, deer, and dog.

"Investigations of native cattle led to the observation that they are host in almost every instance to *Babesia bigemina*, filaria, sarcosporidia, and a large trypanosome, probably of a harmless type. Two cattle revealed a spirochete, probably *Spirocheta theileri*."

A trypanosome of Panamanian cattle and a method for concentrating trypanosomes in peripheral blood, O. TEAGUE and H. C. CLARK (*Jour. Infect. Diseases*, 22 (1918), No. 2, pp. 154-158).—"Trypanosoma theileri" occurs in large percentage of beef cattle in Panama. It is present in such small number in the peripheral blood that stained smears are uniformly negative. After defibrinating the blood, treating with an equal volume of distilled water, and centrifugating, we find it almost always in smears from the sediment. Filaria are also readily demonstrated in the blood of Panamanian cattle by the same procedure, although they are very rarely found in ordinary blood films. The trypanosome is readily cultivated in broth at 24 to 26° C., but undergoes marked changes in morphology in the culture. Inoculation into species of animals other than cattle yielded negative results."

**Eradication of the cattle tick.** F. THOMSON, F. KEOGH, and G. TUCKER (*Queensland Agr. Jour.*, n. ser., 8 (1917), No. 6, pp. 302-307).—A report on observations of the efficacy of tick-destroying mixtures.

**Staggers in sheep in Patagonia.** F. S. JONES and J. F. ARNOLD (*Jour. Expt. Med.*, 26 (1917), No. 6, pp. 805-823, pls. 4, fig. 1; *abs. in Jour. Amer. Vet. Med. Assoc.*, 52 (1918), No. 4, pp. 473, 474).—This report from the Department of Animal Pathology of The Rockefeller Institute for Medical Research relates to investigations made of a nervous disease of sheep which during the past few years has become more prevalent throughout portions of Patagonia. It is not confined to the ovine species alone; horses and cattle readily succumb to it. The affection is known by a number of names, among the more common being staggers, tembleque, loco, and huecu. The disease seems to be widespread, existing throughout the pampas at least as far north as the Chubut Valley and extending southward to Deseado and from the eastern boundary of the pampas to the Andes. The incidence varies greatly with the condition of the food supply, the actual number of cases being small when there is a liberal amount of grass, but after a long-continued drought when the fine grass supply is short the number of sick animals is large.

The investigations reported, based upon experimental work both in the field and laboratory, have led the authors to consider the following conclusions justified: "Staggers is a noninfectious disorder affecting horses, cattle, and sheep. The disease is characterized by weakness, muscular twitching, irregular movements of the head, stiffness of the limbs, and transient motor paralysis, accompanied with spastic spasms on excitement. There is also a derangement of vision and conjunctivitis. The post-mortem lesions are not characteristic. We readily produced the disease by feeding susceptible sheep on a coarse tuft grass, commonly known as colton or pampas grass (*Poa argentina*). The time required to produce definite symptoms by feeding the grass varied. Two animals developed typical staggers after two feedings; in another instance a period of 21 days of feeding was required. The average time for the production of unmistakable symptoms in our experiments was 10 days. Many sheep recover from staggers spontaneously. A complete change of diet will usually effect a cure within two weeks. Older animals that have pastured for long periods on lands where the grass grows become tolerant and rarely are affected with staggers. The grass is toxic to sheep at all seasons of the year. We fed late winter and early spring grass and grass in flower, and produced staggers in every instance. The young green grass is as toxic as any edible portion of the plant."

[*Diseases of the horse*], F. A. HOFFMAN (H. BUSCHDAUER) (*Das Pferdebuch des Amerikanischen Farmers*. Milwaukee, Wis.: Germania Pub. Co., 1917, rev. ed., pp. 228, pls. 3, figs. 46).—This is a small handbook which deals largely with the anatomy and diseases of the horse.

**Pyotherapy in the treatment of harness wounds.** VELU (*Rec. Méd. Vét.*, 94 (1918), No. 1-3, pp. 19-21).—In connection with researches on pyotherapy, previously noted (E. S. R., 38, p. 588), the author has shown the efficacy of the method in the treatment of nonspecific lesions in horses and mules caused by the harness. The cases were treated with polyclonal vaccines, either anti-trypanococcic vaccine or vaccine prepared from the products of ordinary suppurations.

**Some external parasites of poultry.** D. C. MOTE (*Ohio Sta. Bul.* 520 (1917), pp. 139-156, figs. 15).—This is a brief popular summary of information for use by poultry raisers.

## RURAL ENGINEERING.

The subterranean waters of Australia, J. G. RICHEIT (*Abs. in Chem. Ab.*, 12 (1918), No. 8, p. 841).—Referring to the decrease in the capacity of wells in the artesian districts of Australia, two theories of the source of the water of these wells are discussed: (1) That the wells are fed by infiltration of rain-water and by condensation of air circulating through the underground, and (2) that the waters are chiefly plutonic, stored in the underground during preceding geological ages. The author thinks that both views are probably correct and that the progressive decrease of the flow from the wells is not proof of exhaustion of local stores of water but is due to a progressive sinking of the free-water level which may go on for hundreds of years.

Reducing seepage in earth reservoirs, S. T. HARDING (*Jour. Electricity*, 3 (1917), No. 11, pp. 493-496, figs. 2).—This article gives data showing the effectiveness of clay puddle, oil, and concrete linings in reducing seepage in earth reservoirs. Cost data are included, it being shown that a clay or oil lining costs about 1 ct. per square foot, plaster linings about 3 cts., and heavy concrete linings about 6 cts. per square foot.

Septic sewage tanks of tile pipe, J. H. PEARY (*Dom. Engin.*, 81 (1917), No. 11, pp. 454-457, figs. 6).—This is a discussion of the design and construction of small septic tanks of tile pipe, in which sedimentation is considered the primary factor. It is pointed out that a shorter period of detention and a very much higher rate of velocity than is used with the tanks of larger size will accomplish quite satisfactory results with reference to sedimentation. In spite of the fact that a septic tank is described, no effect of bacterial action is discussed as a factor in the clarifying process.

Durability of cement drain tile and concrete in alkali soils, R. J. WIGG, G. M. WILLIAMS, and A. N. FINN (*U. S. Dept. Com., Bur. Standards Technical Paper* 95 (1917), pp. 94, pls. 44, fig. 1; *abs. in Engin. News-Rec.*, 78 (1917), Nos. 2, p. 81; 5, p. 277; *Jour. Franklin Inst.*, 183 (1917), No. 5, pp. 625-628, fig. 1; 185 (1918), No. 3, pp. 410, 411).—“The report covers a cooperative investigation, under the auspices of the Bureau of Standards, into the disintegration of concrete when exposed to strongly alkalized soils and waters in the arid regions of the western part of the United States. In some cases well-fabricated structures are attacked. In other cases the structures do not appear to be affected by the salts. The purpose was to discover, if possible, the causes of such action and to ascertain the best methods of avoiding deterioration.

“The paper shows that the use of cement is still experimental, that porous tile are especially liable to attack, that even dense tile are subject to surface disintegration. The action seems to increase with sulphate and magnesium content. Rather full data are given and the paper is well illustrated with photographs, diagrams, and graphic charts.”

Economical proportions for Portland cement mortars and concretes, J. A. KIRTS (*West. Engin.*, 8 (1917), No. 11, pp. 429-433, figs. 4).—This paper was presented before the American Society for Testing Materials, and reports test from which the following conclusions are drawn:

As regards mortars “sand-cement mortars are not comparable in simple weight proportions because of the wide variation in the corresponding volumetric-proportions and the variations of the void-filled ratios. Sand-cement mortars are not comparable in simple volumetric proportions because of the wide variations of the void-filled ratios. The void-filled ratio has a general effect upon the strength, permeability, and economy of a mortar and undoubtedly affects the density and yield. An important function of the cement-paste is to fill the voids in the sand. Sand-cement mortars are properly comparable

to the basis of the void-filled ratios. The economical proportions for sand-mortars depend upon the void contents of the sands. . . . The economy factor expresses the relative efficiency of mortars. . . . No general relation of air-content, uniformity, coefficient, and absorption to the efficiency of sands is found."

As regards concretes "an important function of a mortar in concrete is to fill the voids in the coarse aggregate. The efficiency of a concrete mixture depends largely upon the efficiency of the mortar. For economical proportions the volume of cement should be equal to or greater than the volume of voids in the sand, but should not exceed 1.5 times the voids in the sand, and the volume of mortar should be equal to or greater than the volume of voids in the coarse aggregate, but should not exceed 1.5 times the voids in the coarse aggregate."

Cement saved by using screened and remixed gravel instead of pit-run gravel, J. P. NASH (*Engin. and Contract.*, 48 (1917), No. 19, p. 370, figs. 2).—Experiments are reported which showed that the pit gravel used to make a 1:7 mix, when screened and remixed in the proportions of 1:3.5:7, required 1.8 sacks less cement to make a cubic yard of concrete. "This is in spite of the fact that the latter shows a 20 per cent increase in strength." A table is given showing the amounts of material required to make a cubic yard of concrete, using pit-run gravel. "It is believed that the amount of pit-run gravel or screened gravel required for a cubic yard of concrete will be but little different even though the proportion of sand in the pit-run gravels varies considerably. The saving in cement, however, would be greater in direct ratio with the amount of sand in the pit-run gravel."

Tests of blast-furnace slag as aggregate in concrete (*Cement and Engin. News*, 29 (1917), No. 12, pp. 308-310, fig. 1).—Experiments conducted at the Pittsburgh testing laboratory are reported.

"One-half of the tests of the slag concrete were made using slag produced by the quick-cooling process in pits, in which the slag is shipped within a few days from the time it comes from the furnace, and the remainder from slag which had been seasoned in banks for a period of 6 months in some cases and as much as 15 years in one case. The length of time during which this series of tests has been conducted does not warrant the drawing of any definite conclusions, but the general uniformity of the results of the crushing tests of the concrete should be observed. Slags coming from furnaces many hundred miles apart, varying quite widely in chemical analyses, and also varying considerably in the weight per cubic foot, do not vary in strength in proportion to either the weight or percentage of any chemical constituent."

Experiment of Wisconsin Highway Commission in improvement of sand roads by hay and tar mats, H. J. KUELLING (*Engin. and Contract.*, 48 (1917), No. 19, pp. 362, 363, figs. 8).—An outline of the construction of experimental sections is given. These are to be reported on later.

Applications of motors to piston pumps and pump jacks (*Jour. Electricity*, 39 (1917), No. 10, pp. 463, 464, fig. 1).—Practical information is given on the proper length of belting, motor speed, foundation, etc., including a table of corresponding sizes, a formula for determining diameters, and rules for other elements involved.

"From the electric standpoint, the principal points involved in making installations of this kind are the selection of a motor of the proper size and starting characteristics, and suitable protective and controlling devices. Except in special cases, the motor selected should be large enough to permit the pump to be operated continuously without overheating of the motor. It is not good practice in these installations to adopt a smaller motor and depend upon the

overload capacity and the intermittent nature of the service to prevent overheating in the motor. In selecting motors based on the intermittent duty rating there is always the danger of choosing a rating too small for the work and therefore possibilities of overloading the motor. When single-phase motors are used for these installations they should be of the repulsion-induction type on account of the high torque developed at starting."

**Electric plowing.** A. DELAMARRE (*Rev. Gén. Élect.*, 1 (1917), May 5, pp. 69-700; *abs. in Sci. Abs., Sect. B—Elect. Engin.*, 20 (1917), No. 236, pp. 285-287).—"The author discusses various systems of power plowing and shows the advantages of electric plowing. Tractors are not essential for deep plowing; the windlass and rope method is equally effective, uses cheaper equipment, and does not consolidate the soil in the same way as a heavy tractor. The tractive effort required varies with the nature and condition of soil and with the depth and breadth of the furrow. Ringelmann's tests with double Belgian plows indicate that the tractive effort per dm.<sup>2</sup> is as follows: Light soil, 36 to 40 kg.; heavy soil, 55 to 60 kg.; alfalfa (4 years), 87 kg.; heath . . . 63 kg. A general formula for work done is  $P=klpv$ , where  $k$  is a tractive coefficient varying with the nature of the soil,  $l$  the width and  $p$  the depth of furrow, and  $v$  the speed of plowing.

"A given area may be plowed to specified depth in specified time either by plowing a wide strip at low speed or plowing a narrow furrow at high speed. The former alternative necessitates heavy and costly tools, cumbersome and difficult to move; the other method is subject to a speed limit of 2 meters per second, or, better, 1.3 to 1.4 meters per second, beyond which it becomes difficult to steer the plow. To plow 30 cm. deep and 90 cm. wide in heavy soil, using a multi-share plow at 1.4 meters per second, corresponds to  $P=2$ , 208 kg.-m./sec.=30 horsepower. This is the minimum theoretical horsepower, and the hauling gear should be capable of at least 60 horsepower to allow for roots, large stones, and various losses. Electric windlasses built for plowing service are generally of 75 to 90 or 100 horsepower. A 60-horsepower machine under the above conditions will plow about 0.45 hectare per hour or 3.5 hectares per 12-hour day, assuming 65 per cent coefficient of utilization. A 90 or 100 horsepower set will plow 5 or 6 hectares per day, but it is desirable to use a light equipment rather than an extra powerful one.

"Whatever the motive power employed, the plow may be hauled by a windlass or a tractor, or an automobile plow may be used. . . . Rope haulage is at present generally preferred and most widely useful. Two windlasses may be used or one double-drum windlass may drive a loop of rope which runs over an anchored pulley at the other side of the field. With two windlasses only one rope is needed. In either case a tilting double-ended plow is used. The single windlass system costs little more than half the cost of two windlasses, and further important economy results from only a single supply line being needed. On the other hand, anchoring the return pulley is rather troublesome; it takes more time to adjust the gear; rope wear is twice as costly; and the system can only be used satisfactorily on level ground. The double windlass system can be used for spans of 600 meters or more, and over very rough ground. Tractors may be used for shallow plowing (15 to 18 cm.), breaking stubble, harrowing, etc., though they are unsuitable for deep plowing owing to their limited tractive effort and poor tractive efficiency if heavy."

Cost data are also given.

**Quality of plowing and the draft of plows.** R. OLNEY (*Power Farming*, 27 (1918), No. 1, p. 9, figs. 4).—The author, in describing good and poor plowing with reference to plow draft, shows that good plowing depends primarily on the

ondition of the soil and the shape of the moldboards. A moldboard that pulverizes the soil most thoroughly and turns the furrow properly requires proportionately more draft to pull it through the soil.

#### RURAL ECONOMICS.

The new business of farming, J. A. DIMOCK (New York: Frederick A. Stokes Co. 1918, pp. [7]+120).—Among the topics discussed in this book are the following: Size of the farm from a business standpoint, capital necessary in farming, diversity, big crops v. normal, rotation of crops, competition and the laws of prices, fitting the scheme to conditions, coordination of enterprises, the opportunity for the individual, live stock on the farm, and the farm as a home. A brief bibliography is appended.

Report of the land development committee of the Ceylon Agricultural Society ([Colombo: Ceylon Agr. Soc., 1917], pp. 42).—In order to increase settlement upon the land the committee recommends that lands be made available in fair-sized blocks for capitalists on a leasing system, in blocks of under 10 acres for small capitalists on a leasing system, with subsequent rights to freehold after development, and in free grants of land to peasant settlers in regular settlements with provision for their acquiring proprietary rights after a period of 10 years. Great importance is attached to the expeditious survey of lands and the provision of irrigation channels as a preliminary to settlement and to the prompt removal of crown timber. Medical aid and roads should be supplied for all settlements, and a colonization officer and a demonstration plat when the settlement consists of more than 25 families. The Government should also be prepared to furnish these settlements with adequate financial assistance during the initial stages.

Land settlement in the Union: Future of returned soldiers (So. African Agric. Indus., 1 (1918), No. 5, pp. 414-424).—This article describes lands available for settlement, types of farming, terms of disposal, financial assistance, and experience and capital necessary, as well as conditions of settlement in Canada, Australia, and New Zealand.

The Agricultural Holdings Acts, 1908-1914, T. C. JACKSON (London: Sweet & Maxwell, Ltd., 1917, 3. ed., rev. and enl., pp. XVI+356).—This work is intended to serve the dual purpose of supplying a text of the Agricultural Holdings Act of 1908-1914, with commentaries and notes, and a manual on tenant right valuation.

The Torrens system of land title registration (Philadelphia: Dept. Pub. Works (1916), pp. 10).—This report contains a brief history of the system, some comparisons, and a plea for the proper safeguarding of the standards of surveying under the proposed Pennsylvania act.

Annual report of the Jewish Agricultural and Industrial Aid Society, 1917 (Jewish Agr. and Indus. Aid Soc. Ann. Rpt. 1917, pp. 46).—This report continues information previously noted (E. S. R., 36, p. 894), calling attention to the various changes necessary in the organization of the society to meet the present crisis.

The Federal Farm Loan Act, J. E. POPE (Bur. Applied Econ., Dept. Banking and Public Finance, Bul. 1 (1917), pp. 58).—This book points out the salient features of the Federal Farm Loan Act, and discusses its various provisions.

State institution farms, W. B. DURYEA (N. J. Dept. Agr. Bul. 10 (1917), pp. 361-395, pls. 4).—This bulletin describes the management on the farms connected with the various State institutions in New Jersey, and outlines methods for improvement.

Report of the committee on mobilization of high school boys for farm service (Boston: Wright & Potter Printing Co. (1917), pp. 60, pl. 1).—This report describes the methods of mobilization, the organization of the camp, and the results obtained in placing city boys on farms. It recommends the establishment of schools for training camp supervisors and cooks, and local responsibility for recruiting and financing.

The State market commission of California, C. C. PLEHN (*Amer. Econ. Rev.*, 8 (1918), No. 1, pp. 1-27).—This report discusses the activities of the commission, especially with reference to the marketing of fruit and fish.

From car door to consumer, H. C. FILLEY (*Nebraska Sta. Circ.* 5 (1918), pp. 20, figs. 2).—The author points out that the delivery of merchandise from freight car direct to purchaser has been a common practice for many years. He discusses the extent of the use of this method of distribution particularly as applied to apples, its cost, and its effect upon the price received by the producer as well as by the consumer. He concludes that the box car peddler has been a popular means of marketing apples, potatoes, and other products, and that, unless the public is to suffer, his function must be filled by consumers' and other organizations. He also recommends the cooperation of dealers as well as purchasers in ordering by carload quantities.

Live stock economics, I. TANIMURA (*Shiba, Tokyo: Oriental Printing Co. Ltd.*, 1917, pt. 1, 2. ed., pp. [2]+X+88+14, figs. 69).—This is the first part of a report on the live-stock industry, and discusses the industry in the United States, breeding and selection, feeding and management, work animals and farm labor, wool and by-products of sheep, the dairy industry, animal flesh as food, animal waste and products of the packing-house, preservatives of milk meat, etc., cost of production and marketing, human nutrition and animal hygiene, regulations, associations, etc.

Social surveys of three rural townships in Iowa, P. S. PEIRCE (*Studies Soc. Sci., Univ. Iowa*, 5 (1917), No. 2, pp. 88).—Among the topics discussed by the author are the geographical features, population, economic conditions, housing, household conveniences and sanitation, educational conditions and influences, religious conditions, recreation, amusement, and social life.

Monthly crop report (U. S. Dept. Agr., Mo. Crop Rpt., 4 (1918), No. 3, pp. 21-32, fig. 1).—This report contains the usual data with reference to the estimated farm value of important products February 15 and March 1, average prices received by producers, and the range of prices of agricultural products at important centers. It also contains a crop summary for March, special data relating to farm stocks March 1, 1918, and shipments out of the county where grown, of wheat, oats, corn, and barley. It has special articles regarding the methods of hiring farm labor, wages of male farm laborers, the number of farmers and farm laborers in 1910, and contains special data on prices of articles bought by farmers, monthly farm marketing of wheat, conditions in Florida and California as to crops, the world's potato crop, cabbage for kraut, and peas for canneries, wheat held by country mills and elevators, exports of wheat, wheat fed to live stock, and the seed corn deficiency for 1918.

The story of Colorado—farming, mining, manufacturing (Denver, Colo.: State Bd. Immigr. [1917], Nos. 1, pp. 15, figs. 11; 2, pp. 23, figs. 25; 3, pp. 15, figs. 9; 4, pp. 31, figs. 25; 5, pp. 31, figs. 46; 6, pp. 31, figs. 16; 7, pp. 15, figs. 11).—These numbers contain data on the topography, climate, history, crops and live stock produced, together with opportunities for settlement, for each county of the following districts: Northwestern Colorado, the Western Slope, the San Luis Valley, the Arkansas Valley, eastern Colorado, the South Platte Valley, and Southwestern Colorado.

**Agricultural statistics of Denmark** (*Statist. Aarbog. Danmark*, (1917), pp. 174+256+[4]).—This report continues information previously noted (E. S. 37, p. 392), by adding data for a later year.

**The industrial resources of the Union of South Africa**, C. DU CHIAPPINI *our. Roy. Soc. Arts*, 66 (1918), No. 3404, pp. 227-243).—In this report are discussed the agricultural, mineral, and manufacturing resources of the Union of South Africa, together with the extent of the population. For the agricultural resources data are given as to the production and import and export trade.

#### AGRICULTURAL EDUCATION.

**The future of agricultural education and research in the United States**, H. JORDAN (*Science, n. ser.*, 47 (1918), No. 1206, pp. 125-134).—In this, the presidential address before Section M, American Association for the Advancement of Science, the author discusses the problem of efficiency as related to the functions which agricultural colleges and experiment stations should perform, including a consideration of their aims, in which are found the great essentials of educational efficiency.

He concludes briefly that "the agricultural colleges should not establish entrance requirements and curricula chiefly with reference to turning out practicals, but should give prominent consideration to training men and women for effective agricultural leadership." In his opinion agricultural research worthy of the name should depend upon the method or plan under which the scientist is working and the quality of the effort applied to the problem, and not upon the title of the project. He maintains that the history of agricultural science shows clearly that substantial progress has been made only when the studies in the experiment stations have been confined to "the narrow individual factors that are involved in agricultural production, rather than driving directly broad generalization or answers to business problems which include the action of many factors." The conditions essential to the successful direction and maintenance of education and scientific research, which it is agreed, a freedom of administrative initiative, such organization and relations as stimulate both to the teacher and to the research worker, and the possibility of maintaining a continuous policy in the conduct of the institution, are outlined.

With reference to the relation of the Federal Government to the agricultural colleges and experiment stations, the author states that while the earlier general acts placed little restriction upon the several States, Federal supervision under the later Smith-Lever and Smith-Hughes Acts is regarded by many as having approached the danger point, not so much because of what now the Federal policy as because of the future possibilities under the provisions of these acts. The efficiency of agricultural education and research, it is held, is also threatened by the budget system in some States. "There is every reason to fear that if present tendencies toward the closer control of agricultural education and research institutions by committees and bureaus are not checked, efficiency in education and research will abide only with privately endowed institutions."

**Agricultural education.—What is it?** D. SNEDDEN (*School and Soc.*, 7 (1918), No. 160, pp. 66-71).—In this article the author assumes that the chief function of the agricultural school is to train farm laborers along narrow lines, as is common in trade schools, and he ignores the breadth of training necessary for the managing owner of a farm. He also assumes that diversified training should be and will be replaced by intensified specialization. This point of view colors the entire article, as the plea is made for narrow specialization.

The reorganization of high-school science, F. D. BARBER (*School Sci. and Math.*, 18 (1918), No. 3, pp. 247-262, figs. 6).—In this analysis of the nature and the significance of shifts that have occurred and are occurring in the high-school science curriculum, the author claims that "physics is now nearly holding its own, that chemistry is making slight gains, that physical geography, physiology, botany, and zoology are all rapidly losing ground and will soon disappear as high-school subjects, or at least they will soon become unimportant subjects in the high-school curriculum."

Agriculture and domestic economy are everywhere making rapid gains. During the five years from 1910-1915 the percentage increase in relative enrollment in agriculture in the high schools was 54 in the United States, 513 in Iowa, 24 in Wisconsin, 52 in Illinois, and 231 in Ohio; in domestic science 241 in the United States, 533 in Iowa, 237 in Wisconsin, 65 in Illinois, and 340 in Ohio.

Graphs are included indicating that before the advent of agriculture, domestic economy, and general science, 1900-1915, all of the old recognized sciences were suffering a rather rapid decline. The author is convinced that had the courses in the physical and biological sciences, offered in the first two years of the high school, afforded the proper foundation for the study of agriculture and domestic economy, in the better school systems, these two new applied sciences would have been placed farther up in the course, presumably displacing physics and chemistry.

In his opinion, the proper reorganization of high-school science consists in the establishment of a required stem course of science which shall incorporate the elements of historical significance and scholarship from the old régime with the elements of true worth and interest from the new régime. This course should be two years in length and must deal with materials of universal value, present science in its psychological and pedagogical order, not the logical order of special science, and must recognize the natural interests and the point of view of the pupil and not of the trained scientist; it must afford the necessary foundation for an understanding of the principles involved in the art of agriculture and the art of domestic economy, and at the same time it must provide the foundation for the further study of science in the college and university. It should be equally applicable to the 2-year, 3-year, and 4-year high school, and the rural and the urban high school. Its organization must be that of general science and not that of special science, and it might most appropriately be called a "2-year course in general science." Suggested subject matter for such a required 2-year course is outlined and attention is called to its advantages.

In addition to this basic course, every rural high school should offer courses in agriculture and practically all high schools courses in domestic economy. These special courses, however, may be shortened materially, as the basic course will deal with materials closely related to the materials utilized in the special courses. The author believes that they will inevitably treat less of the theoretical aspects of science and more of the practical aspects. Eventually, when the junior high school becomes an important reality, the seventh year may well be devoted to nature study during the fall and spring months, and to physiology and hygiene during the winter months. The first year's work of the proposed 2-year course in general science can be done in the eighth year and the second year's work in the ninth, thus leaving three years devoted to agriculture, domestic economy, or special science courses.

Shall forestry be taught in the public schools? J. W. TOMEY (*Amer. Forestry*, 24 (1918), No. 290, pp. 103-108, figs. 6).—The author advocates instruc-

tion in forestry in the public schools, especially in forested regions. The time for such instruction, in his opinion, should depend largely upon the location of the school and to what extent the pupils of the particular locality will in later life be identified with the production and utilization of forest products. He believes that for the lower grades forestry can best be taught in connection with other subjects. In the primary grades it should be taught as a part of nature study, as is already being done in some parts of the country, and in the grammar grades it should be taught in field excursions and in connection with courses in geography, civil government, and United States history. In the high school, also, the instruction should be mainly in connection with other courses, viz., physical geography, manual training, and botany.

As in most parts of the country the production of farm crops and of wood crops go hand in hand under common ownership, the woodlot being still a part of almost every farm, the author believes that in most localities a part of the work of the agricultural high school should be given to forestry. This work should cover approximately 20 weeks and consist of a course in the introduction to forestry, giving a general knowledge of the subject and the importance of forestry in the economic development of the country, and a course in farm forestry, which should be sufficiently comprehensive to cover all phases of forestry that relate to the production and utilization of timber on the farm.

In view of the fact that forest crops are profitably produced on soils too poor for farm crops, great areas of this country, possibly 20 or 25 per cent of the total area, must remain forever in forest. In these regions forest trade schools or ranger schools are deemed as necessary as trade schools are in cities. Their instruction must aim to teach the art or trade of forestry, including all the operations incident to the ownership and utilization of timbered lands. The character and method of instruction should vary with the local requirements which the student must be prepared to meet after the completion of his course. The instructors should be professional foresters. Such schools should become a part of the public-school system in this country wherever the forest is the dominant resource and provides employment for a considerable percentage of the inhabitants.

Illustrated lecture on renovating the neglected apple orchard, H. M. CONNOLLY (*U. S. Dept. Agr., States Relat. Serv. Syllabus 31 (1918)*, pp. 16).—This lecture, which deals with the feasibility, possibility, cost, and methods of renovating old orchards, is an adaptation of Farmers' Bulletin 491 (U. S. R., 17, p. 241), with additions and changes for the special purpose of aiding farmers' institute and other extension lecturers. It has been prepared in cooperation with the Division of Horticultural and Pomological Investigations of the Bureau of Plant Industry. A list of 50 lantern slides to illustrate the syllabus is included.

#### MISCELLANEOUS.

**Thirtieth Annual Report of Indiana Station, 1917** (*Indiana Sta. Rpt. 1917*, pp. 84).—This contains the organization list, reports of the director and heads of departments, the experimental features of which are for the most part abstracted elsewhere in this issue, and a financial statement for the Federal funds for the fiscal year ended June 30, 1917, and for the remaining funds for the period ended September 30, 1917.

**Thirty-fifth Annual Report of New York State Station, 1916** (*New York State Sta. Rpt. 1916*, pt. 1, pp. VIII-820, pls. 89, figs. 43).—This contains the organization list; a financial statement for the fiscal year ended June 30, 1916; a list of the periodicals received by the station; and reprints of Bulletins

414-428, Technical Bulletins 48-56, popular editions of Bulletins 415, 417, 418, 419, 422, and 423, and Circulars 47 and 48, all of which have been previously noted, and of Circulars 49, The Cherry Leaf-beetle, by F. Z. Hartzell and P. J. Parrott; 50, Periodical Cicada in 1916, by P. J. Parrott and H. E. Hodgkiss; and 51, Some Insects Attacking the Pear, and Their Control, by P. J. Parrott.

Report of the Porto Rico Insular Station, 1916-17 (*Rpt. Bd. Comrs. Agr. P. R.*, 6 (1916-17), pp. 131, figs. 8).—This contains the organization list, a report by the director for the fiscal year 1916-17, and departmental reports, the experimental features of which are for the most part abstracted elsewhere in this issue.

Annual Reports of Virginia Station, 1915 and 1916 (*Virginia Sta. Rpt. 1915-16*, pp. 218, figs. 36).—This contains the organization list, reports of the director and heads of departments, financial statements for the fiscal years ended June 30, 1915, and June 30, 1916, and a number of special articles and reprints of Technical Bulletins 12-18, abstracted elsewhere in this issue.

Monthly Bulletin of the Ohio Experiment Station (*Mo. Bul. Ohio Sta.*, 1 (1918), No. 3, pp. 65-98, figs. 16).—This contains several articles abstracted elsewhere in this issue, together with the following: Spring Wheat, by C. G. Williams; Seed Corn for 1918, by C. G. Williams; Using Forage in Pig Feeding, by W. L. Robinson; Beet-sugar Production, by C. E. Thorne; Delayed Applications of Lime-sulphur, by P. Thayer; Dormant, Spray Controls Peach Leaf Curl; Climbing Roses, by W. E. Bontrager; and notes.

Monthly bulletin of the Western Washington Substation (*Washington Sta., W. Wash. Sta. Mo. Bul.*, 5 (1918), No. 12, pp. 173-188).—This number contains brief articles on the following subjects: Growing and Marketing of Grapes, by R. T. Reid (see p. 49); The Importance of Investigational Work in the Field of Marketing, by A. Hobson; Lousiness in Domestic Animals, by J. W. Kalkus; Dairy Feed Supply, by W. A. Linklater; and War Chicks, by Mrs. G. R. Shoup (see p. 75).

## NOTES.

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**Arizona University and Station.**—E. P. Taylor, of the extension service, has been appointed assistant dean of the college of agriculture. G. E. Thompson, extension specialist in crops in the Kansas College, has been appointed head of the department of agronomy.

**Arkansas University and Station.**—Science states that W. S. Fields has resigned as assistant professor of plant pathology and assistant plant pathologist to take up work as extension plant pathologist under the Bureau of Plant Industry of the U. S. Department of Agriculture, with headquarters in Mississippi. G. Becker, assistant professor of entomology and entomologist, has resigned to enter military service, and was succeeded June 20 by W. J. Baerg.

**California University and Station.**—It is announced that over 34,000 students are now enrolled in the 27 correspondence courses in agriculture offered by the university. A two months' course at Davis in practical farming was recently completed by several women.

Dr. J. C. Whitten, professor of horticulture and horticulturist at the Missouri University and Station, has accepted a position as head of the division of entomology.

**Georgia College.**—John T. Wheeler, assistant professor of horticulture in the Massachusetts College, has been appointed head of the department of agricultural education, with L. M. Sheffer as assistant in charge of agricultural education work in secondary schools.

**Hawaii College.**—L. A. Hanke has been appointed head of the department of agriculture.

**Purdue University and Station.**—A second division of the Boys' Working Reserve has completed its training under the school of agriculture, making available several hundred boys for farm service.

C. M. Vestal, in charge of animal nutrition work at the Kansas College and Exchange professor during the past year with the University of California, has been appointed associate in animal husbandry. Dr. G. H. Roberts has been appointed associate veterinarian in the station. J. C. Beavers, assistant in soils and crop extension, resigned August 31 to return to his farm in North Carolina, and R. A. Nehf, assistant in horticulture, to enter a Coast Artillery camp.

**Iowa College and Station.**—Recent appointments include the following assistants: Edgar Collins in agricultural engineering, D. M. Merrill, P. E. Noraker, H. J. Harper, B. J. Firkins, A. J. Elwell, T. H. Benton, P. C. Wiechman, J. H. Artiss, and F. M. Russell in the soil survey, F. S. Wilkins in farm crops, J. R. Morgan in dairying, and J. L. Horsfall in entomology. Leave of absence for the duration of the war on account of military service has been granted to F. Jensen, assistant in field crops, and D. E. Bailey, assistant in dairying. Dr. Orren Lloyd-Jones, associate professor of animal husbandry, and Paul M. Wolf, assistant in the soil survey, have also resigned.

**Kansas College.**—Arrangements have been completed for the enrollment of the students of the Kansas City Veterinary College, which is closing for the period of the war.

Dr. C. W. McCampbell, associate professor of animal husbandry and secretary of the State Live Stock Registry Board, has succeeded W. A. Cochel, resigned, to become western field man of the American Shorthorn Breeders' Association, as head of the department of animal husbandry. H. F. Lienhardt, in charge of poultry disease investigations, has been granted leave of absence for the period of the war to engage in military service as second lieutenant in the Medical Corps.

**Louisiana Stations.**—G. D. Cain, chief chemist of the fertilizer control laboratory, has been appointed assistant director of the North Louisiana station at Calhoun. W. M. Hall, assistant chemist at the State station, has been appointed chief chemist of the fertilizer and feedstuffs control laboratory. J. H. Jolley and C. F. Sheffield have been appointed assistant chemists.

**Maryland College and Station.**—President A. F. Woods has been selected as chairman of the Agriculture Committee of the National Research Council.

Recent appointments include the following assistants: C. C. Shivers in veterinary medicine, A. M. Smith in soil chemistry, and S. V. Eaton in plant physiology.

**Minnesota University and Station.**—H. H. Kildee, chairman of the dairy husbandry division, has resigned to become chief of the animal husbandry division of the Iowa College. J. S. Montgomery, associate professor of animal husbandry, has resigned to engage in commercial work, and Earl Weaver and H. R. Searles, respectively, assistant dairy husbandman and instructor in dairy production, to enlist in the United States Marine Corps.

Thomas Shaw, professor of animal husbandry from 1893 to 1903, died June 26, aged 75 years. Prof. Shaw was a native of Ontario, and from 1888 to 1893 was instructor in the Ontario Agricultural College. He was the author of several text-books covering a wide range of agricultural topics.

**Missouri Fruit Station.**—F. W. Faurot, whose resignation as extension assistant professor of horticulture at the University of Missouri has been recently noted, has been appointed director.

**Nebraska University.**—C. W. Pugsley, director of the extension service, has resigned to become editor of *Nebraska Farmer*, and was succeeded July 14 by Charles E. Gunnels, formerly State leader of county agent work.

**Nevada Station.**—The station is planning a study of methods of increasing hay production in the Humboldt Valley, largely by improved methods of irrigation and cultivation, and in cooperation with the Office of Public Roads and Rural Engineering of the U. S. Department of Agriculture.

**Cornell University and Station.**—The summer session of the College of Agriculture had an enrollment of 334 persons. At the request of the State authorities a special course in agriculture for vocational teachers was offered, with a registration of 20. This course was open only to persons not in the draft and experienced in farming.

Dr. V. B. Stewart, assistant professor of plant pathology and plant pathologist, has accepted an appointment in the Bureau of Plant Industry of the U. S. Department of Agriculture and is engaged in work on the pathological inspection of vegetables. E. R. King, assistant professor of entomology, has been commissioned second lieutenant in the Aviation Corps.

**North Carolina Station.**—Through a State appropriation the station has added about ten offices to its quarters in the building of the State Department of Agriculture.

The recent establishment of a sheep experimental farm in the mountain section of Mitchell County, in western North Carolina, has materially enlarged the facilities of the station for studying sheep under actual farm conditions. The farm is in charge of W. R. Radford.

Dr. J. Kemp Plummer, soil chemist, has been given leave of absence for the period of the war to work on the manufacture of explosives.

**North Dakota College and Station.**—Dr. P. F. Trowbridge, head of the department of agricultural chemistry in the Missouri University and Station, has been appointed director. Dr. H. L. Kraybill, assistant physiologist in the Bureau of Plant Industry of the U. S. Department of Agriculture, has been appointed chemist in the station, to succeed W. L. Stockham, resigned to accept a position with this Department. Other appointments include Miss Cecil Yampolosky and Dr. Wanda Weniger as assistant botanists and plant pathologists, and Miss Ada Lewis as assistant professor of home economics.

**Ohio Station.**—L. L. Rummel has resigned as editor to become associate editor of the *Ohio Farmer*.

**Pennsylvania College and Station.**—R. S. Smith, assistant professor of agronomy and assistant agronomist, resigned June 1. J. W. Miller, assistant professor of botany and assistant botanist, has been granted leave of absence to engage in military service. Recent appointments include J. W. Mitten as assistant in dairy husbandry and W. S. Beach as instructor in plant pathology research at the field laboratory at Bustleton, effective June 1; and R. G. Bressler as professor of rural sociology, F. T. Struck as associate professor of agricultural education, and George Wehrwein as associate professor of rural economics, effective September 1.

**South Dakota College and Station.**—The new poultry building is under construction. E. L. Dakan, recently appointed assistant in poultry husbandry at the Missouri Station, has been appointed to take charge of the poultry department, and it is expected to begin experimental work at an early date.

Reginald Sherwood, assistant professor of chemistry and assistant chemist, and George Gilbertson, instructor in entomology, are now in military service.

**Tennessee University and Station.**—Plans are being prepared for a central administration building, to cost about \$500,000, and an armory building, to cost about \$150,000.

Provision has been made for the establishment of a new department to take charge of activities under the Federal Aid Vocational Education Act.

The forty-fifth annual session of the East Tennessee Farmers' Convention was held at the station farm, May 14-16, with an attendance of approximately 3,000 persons. The program consisted almost entirely of topics bearing on war activities, and action was taken whereby the entire membership fees of the year, aggregating about \$1,000, are to be devoted to the purchase of bonds of the Fourth Liberty Loan.

Capt. William Rule, secretary of the board of trustees, has resigned after 50 years of service on the board and has been succeeded by Thomas D. Morris, treasurer of the board. Captain Rule has been given the honorary degree of Master of Arts.

**Utah College and Station.**—The new live stock building has recently been completed but is being used as a barracks for soldiers stationed at the college for technical training.

A department of range management has been established in the college and station, in charge of Raymond J. Beemert.

**Virginia Station.**—E. T. Batten, superintendent of the Nansemond County Substation at Holland, has been called for military service.

**Virginia Truck Station.**—Albert White, assistant horticulturist, resigned July 15 to enter military service.

**Wisconsin University and Station.**—J. L. Tormey, associate professor of animal husbandry and animal husbandman, has resigned to become field man of

the American Shorthorn Breeders' Association. E. R. McIntyre, assistant in agricultural journalism, has resigned to become associate editor of *Wisconsin Farmer*.

**Wyoming University.**—Dr. S. K. Loy has resigned as professor of chemistry to engage in commercial work. Miss Greta Gray, of the Kansas State Normal School, has been appointed head of the department of home economics.

**United States Food Administration.**—Dean H. L. Russell has returned to the University of Wisconsin. His duties have been divided between Dean W. R. Dodson, of the Louisiana University, who will deal with matters of joint interest to the Food Administration and the U. S. Department of Agriculture, and E. S. Brigham, commissioner of agriculture of Vermont, who will head the butter and cheese section.

**Studies of Instruction in Vocational Agriculture.**—A cooperative agreement has been adopted between the U. S. Department of Agriculture, the Bureau of Education, and the Federal Board for Vocational Education respecting the studies relating to instruction in agriculture authorized by the Federal Aid Vocational Education Act. These studies, which under the terms of the act may be made in cooperation with or through the Department of Agriculture or the Bureau of Education, are to be carried on under the direction of the Federal Board. A committee representing each of the three agencies is to be formed to consider and recommend projects to the Federal Board. Investigators under approved projects may be detailed by the Department of Agriculture or the Bureau of Education to the Federal Board or representatives of the board may be detailed to cooperate with the other departments in making the studies. The results are eventually to be published by the Federal Board.

**Agricultural Education in Mysore, India.**—Three grades of agricultural education are being offered in Mysore and meeting with popular success, viz: (1) higher education, in the English language, leading to a diploma at the Hebbal School; (2) a somewhat lower grade of training given at the vernacular school at Chikkannahalli; and (3) rural science classes in selected rural vernacular schools sanctioned by a Government order of March 22, 1916, which aims at combining some agricultural training with elementary education. Four such schools were started recently, the work being under the supervision of a rural science supervisor who visits each school once a week and who is under the direction of the Deputy Director of Agriculture. The head masters of these selected schools had taken a course in agricultural training in the Mysore Normal School, followed by a course in May and June at the Hebbal School under the direction of the rural science supervisor. It is proposed to continue these vacation courses for teachers who are to give instruction in agriculture in the rural schools.

**Agricultural Rehabilitation in France.**—According to a letter printed in *Breeder's Gazette* from C. N. Arnett, now on leave from the Montana College and Station, a 500-acre farm at Ferme le Courbat, Le Liege, Indre et Loire, France, has been leased by the American Red Cross as an agricultural center for the reeducation of French mutilated soldiers. Barracks and farm equipment have been provided, and it is expected to accommodate from 125 to 150 men at one time. Courses in agriculture of 3, 6, and 12 months' duration are contemplated, including both lectures and practical work. It is estimated that about 65 per cent of these men came originally from farms and it is hoped in this way to restore them to the land and so help solve the future agricultural problem of France.

**New Experiment Station at Guadeloupe, French West Indies.**—This station has been recently organized by the Syndicat des Fabricants de Sucre of Guade-

oupe with the special object of improving sugar-cane yields in the island, which is one of the largest producers of sugar in the Lesser Antilles. The different types of soil will be studied, and experiments with tillage, liming, manuring, etc., will be carried out, along with the testing of different varieties of cane—both imported and locally grown. In addition, experiments will be undertaken with rotation crops, green manure crops, forage and pasture crops, etc.

The scientific staff at present consists of a director, who is also in charge of the entomological and pathological work, an assistant director, who is also a chemist, and two field assistants. The director is J. Sydney Dash, a graduate of Macdonald College, who has been connected with the sugar-cane work of the Department of Agriculture, Barbados, for a period of eleven years. The assistant director is Charles T. Alder, previously assistant chemist at the St. Croix Experiment Station.

**Experiment Station of Agricultural Bacteriology of Crema, Italy.**—This station was founded in 1914 as a corporate body by a royal decree, with funds supplied by the agricultural ministry. During the last year it has had an additional grant of \$12,000, besides its original fund of about \$30,000.

The station has been engaged chiefly in continuing the studies of agricultural bacteriology which were begun in the laboratory of agricultural bacteriology belonging to the Lodi-Creamery Station and has kept the same laboratory personnel. Special prominence has been given to three problems: (1) The conservation of forage in the silo by mechanical pressure (in this particular type of silo the forage is not subjected to heating since it is entirely closed from the contact of air); (2) the making of Italian cheeses with pasteurized milk and selected lactic ferments; and (3) the preparation of lactic ferments for therapeutic uses.

The station has thus far issued bulletins dealing with silos with mechanical pressure and the lactic ferment in therapy.

The station staff consists of 15 persons, with Dr. Franco Samaranl as director and Dr. Carlo Blanchiari chemist and vice-director.

**New Journals.**—The *New Zealand Journal of Science and Technology* is being published bimonthly by the New Zealand Board of Science and Art as a medium for the publication of papers contributed by the Government departments and others and for the present of some articles of more popular nature. Longer scientific papers are to be issued as bulletins of the board, but credited to the Government department from which they originate. Existing serial publications, such as the *Journal of Agriculture* are not affected by the new arrangement, but it is hoped to bring together and render more accessible a considerable amount of material hitherto widely scattered in pamphlet form, parliamentary papers, etc.

*Archivos da Escola Superior de Agricultura e Medicina Veterinaria* is being published by this school, located at Pinheiro, State of Rio, Brazil. The initial number contains a catalogue of the species of Cholina of the Curculionidae, by Dr. A. Da Costa Lima, chief of agricultural entomology.

*Occasional Notes* is being issued from time to time by the Royal Agricultural Society of Great Britain, with a view to getting before the public more promptly information which has heretofore been published only in the annual reports of the society.

The Secretary of Agriculture of Cuba has established *Revista de Agricultura, Comercio, y Trabajo* as the official organ of the department and with Felix Calejas as editor. It consists chiefly of articles of general agricultural interest and official notices.

*La Revista Agricola* is being published monthly as the official organ of the Direction of Agriculture by the Secretary of Works of Mexico, succeeding the

monthly bulletin previously issued. The initial number contains a variety of brief articles, including several on the cultivation of sisal, a description of the plant propagation and acclimatization gardens, the use of tractors in Mexican farm separators, etc.

*Revista del Instituto Bacteriologico* is a quarterly being published at Buenos Aires by the Bacteriological Institute of the Argentine National Department of Health. It consists mainly of scientific contributions along the lines of pathological bacteriology.

*Revista Medico-Veterinaria* is the monthly organ of the College of Veterinary Medicine of São Bento, Brazil. The initial numbers contain several articles reporting experimental work carried on at the institution.

*Zoopathologica* is being published by the New York Zoological Society as a medium for its scientific contributions on the diseases of animals.

**Miscellaneous.**—The report of a committee appointed in Great Britain in 1916 to inquire into the position of natural science in the educational system is summarized in a recent issue of *Nature*. Advanced ground is taken as regards the desirability of greater attention to scientific training in the elementary and secondary schools. The committee, however, reports that specific instruction in agriculture or agricultural science should not be given in these schools, "though in favorable circumstances a rural bias may be given to the work of a secondary school. All county educational authorities, acting either singly or in co-operation, should furnish well-equipped farm institutes for their areas."

The London *Times* announces that the Royal Agricultural Society is endeavoring to supplement its long continued studies at Woburn by observations in other localities. Members of the society are being invited to cooperate in experimental work which, according to the preliminary announcement, will include tests of the continuous growing of grain, green manuring, unexhausted manorial values, the use of lime, treatment of pastures, and calf raising.

A series of short courses is being carried on at the University of British Columbia for returned soldiers. A course in fruit growing was attended by 44 returned men and one in agronomy and animal husbandry by 48. A course in agriculture and farm work began July 1 to continue for from three to six months. Requests have also been made for short courses in poultry keeping, vegetable gardening, apiculture, and dairying.

The senate of the University of New Zealand has agreed to include agriculture among the subjects for the ordinary B. A. and B. S. degrees. It has recommended also that for the purpose of encouraging the study of forestry the university appropriate \$730 a year for three years for a traveling scholarship in forestry, provided that the Government contribute a like sum and make some arrangements for the employment in the forestry department of the scholar on the expiration of his scholarship.

The agricultural school and experiment station near Panama City, Panama, started in 1915, has been closed for lack of funds. Dr. B. H. A. Groth, formerly of the New Jersey Stations, who has been in charge of the school and station since its establishment, has returned to this country.

